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Errata.

On the plate opposite p. 92 for 332 read 342.

p. 135 second footnote for 1253 read 1532,

p. 136 second delete the 30th line,

p. 141 last column, the asterisk is one line too high.

Photos by] [*H. Overbeck, Esq.*

Cycas damaged by *Catochrysops pandava*.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. II. Issued July 4th, 1918 No. 1

CATOCHRYSOPS PANDAVA, A BUTTERFLY DESTRUCTIVE TO CYCADS.

Catochrysops pandava, Horsf., is a beautiful little butterfly when seen with its silky lavender blue wings expanded; but it is very destructive in a garden to Cycads: for the caterpillar is a *gourmet* and feeds on the youngest leaves, utterly destroying them, so that the plant is left untidy for the months which pass until it can produce a fresh crop. How untidy it can be, is seen in the accompanying plate. Cycads which had been attacked by the insect and had no young leaves left, produced in the Botanic Gardens a new crop at the end of three months, often only to be attacked again.

The butterfly is 30—35 mm. from tip to tip of its upper wings. The wings are silky lavender blue above shading slightly towards black, then bordered with a narrow line of black, outside a very narrow white line, with a black dot just inside the border on the lower wings and a fine slightly twisted black tail from the edge against it, this tail just tipped with white. Below the wings are dove grey with darker white-bordered wave markings and eyes chiefly in the outer half, and with a black eye marking against an orange patch at the hinder angle of the hinder wings. The body is steel grey below, and with the wings closed the insect at rest is well hidden by the pattern. The female insect is duller in colour above than the male especially by having much more black suffused through the blue on the upper surface of the wings: otherwise its colours are similar.

A female insect laying eggs, walks about the backs of the still curled pinnae of the Cycad leaves, moving the tip of her body up and down and at each light touch attaches a single egg to the surface of the plant.

These eggs are beautiful objects; they are depressed, and there is a slight pit at the unattached pole with round it rings of minute warts connected together by a slight webbing, the meshes increasing in size to the equator. Three or four days after the egg has been

laid a small white caterpillar breaks through outward and commences to feed; for that purpose generally moving to the upper side of the uncurving leaf. It is shaped like most caterpillars are, except for a tendency to draw its head under the body; it has relatively long, pale, but not numerous hairs. Later it changes colour and develops a fold down either side joined, each to the other, in a kind of collar at the back of the head, which quite alters its appearance; for now it is flattened, and the legs and head are hidden. In the course of three weeks, it has grown to a length of 8 mm. with a breadth of 3 mm. It is more conspicuously flattened towards the head and towards the tail than at the center of the body; but nevertheless is flattened throughout. Its colour is a reddish crimson, and the dorsal surface is covered with small black bristles among which over eight segments there are four undefined lines of smaller white clavate hairs; towards the side the bristles are colourless. From the flattened hinder end, two curious scent organs can be exserted; they are colourless and with a few colourless hairs; when exserted they are minute columns; and a kind of irresolute movement is given to them by repeated retractions and exsertions. This red grub can spin a thread at all times.

When mature at 21 days it pupates, on the back of a leaf or in some other sheltered place, into a short plump light green pupa hanging by its tail and girdled by a thread holding it against its support. The eyes come to show reddish and the wing covers look pale.

By the time pupation has been reached the pinnae of the leaf of the food plant have generally been utterly destroyed while the grub has been feeding for the last part of its time by burrowing into the fleshy young axis of the leaf. It moves about a little but never far. What with the gumming resulting from the wounds, and with the raggedness resulting from the dead scraps of pinnae left attached, the beauty of the plant has been utterly destroyed. The lower block on the plate shows about 30 destroyed leaves and five that have more or less escaped,—an evidence of the small distances through which the grubs move, for they had not wandered to the pinnae which had not received eggs.

The butterfly also appears not to move far, for Cycads at a distance no greater than a quarter of a mile from attacked Cycads, have been seen to escape repeatedly.

Two species of Cycas are attacked in the Botanic Gardens, *Cycas Rumphii,* and *Cycas siamensis.*

Other food plants have been looked for but not found. The cause of suspecting that the caterpillar has other foods is that young Cycad leaves are available only at intervals which it may be that the insects cannot always keep. But the length of the life of the butterfly on the wing has not been ascertained: it may be so long as to fill in the interval between its emergence at 5 weeks from the egg-laying and the Cycad's ability to produce a new foliage.

An arsenical spray may be used as a remedy.

I. H. BURKILL.

IDENTITY OF A COCONUT HISPID.

Recently, Mr. R. M. Richards, of Caledonia Estate sent to me specimens of what Peninsular entomologists have been calling *Bronthispa froggattii,* a small but destructive Hispid beetle occurring on coconuts. It can be recognized by its small size, black color, and red pronotum. *Bronthispa froggattii* was originally described from the Solomon Islands, and since there was some question as to the positive identity of the Malayan form, specimens from Mr. Richards and also specimens which I had taken in Singapore were sent to Dr. Gestro in Genoa, one of the best known authorities on the *Hispidae.* Dr. Gestro now replies that he possesses typical specimens of *Bronthispa froggattii* and that our form cannot possibly be associated therewith, on the other hand he states that the Malayan beetle is clearly *Plesispa Reichei* Chap., originally described from Malacca. I do not know how the erroneous determination first got into Peninsular literature.

C. F. Baker.

PROMECOTHECA CUMINGII, BALY, ANOTHER COCONUT HISPID AND A PEST IN MALACCA.

Mature larva and imago of Promecotheca cumingii, enlarged 2½ times.

Upon a visit of inspection to Malacca in July, 1917 it was observed that some pest had been attacking the Coconut palms in a serious way between Malacca town and Tanjong Kling, seven miles distant. The effect of the attack was apparent to any one, even at some distance, by the brown colour of all the old leaves; every palm in the area of attack appeared as if scorched, appeared as if attacked by the moth *Brachartona* which produces this appearance: but on examination of the trees it was obvious that *Brachartona* had not done the damage.

The young leaves were found to be free, for the most part, from any cause of injury, but on the intermediate leaves sharply defined areas of dead tissue were to be seen: and on the older leaves these areas had become confluent; and the tissues were generally dead and often tattered. The cause of the injury was not detected on the first visit, but the limits of its attack were ascertained as above, Malacca town to Tanjong Kling, and inland only about a mile.

Arrangements were then made that an officer of the Department, namely Professor Baker, should thoroughly investigate the attack by an early visit; but advance information to the effect that the Government of the Philippines intended to recall him interfered with the plans in such a way that the next inspection in Malacca only took place in December, when the writer was fortunate enough to find the pest,—a beetle,—mature and on the wing. This beetle proves to be *Promecotheca cumingii.*

Promecotheca cumingii is about 10 mm. long, a flat bright umber beetle shaped as drawn on p. 3, which by day can be found resting on the shaded side of coconut leaves or sometimes on the leaves of other plants. Its food in maturity as well as when immature is the leaf of the coconut, the grub may also be found in the leaves of the Nipa palm and in the leaves of the Sago palm, but, so far in Malacca never abundantly.

The mature insect is apparently not of wide flight for it spreads only a little to isolated groves of coconut palms behind the continuous fringe that skirts the sea. However that it can live at a distance from the sea is proved by its appearance recently at Bringin some four miles inland; and doubtless if sufficiently searched for it would be found at other inland places.

Latterly it has spread along the coast to Pangkalan Balak at a distance of 14 miles from Malacca, as the crow flies. It seems to have in it the power of spreading further, and freely so long as the belt of coconuts is more or less continuous.

In the Philippine islands, this insect is a minor pest. Mr. C. R. Jones in the *Philippine Journal of Science,* Section D. viii., p. 127, after describing it, says that it has many enemies, predacious and parasitic, and that it is probable the parasites keep it in check. At present we have no knowledge that it has any enemies in Malacca, but this is because observation has not yet been made. This much, however, can be said (i) that something appears to have caused the pest to die down in the neighbourhood of Malacca Railway Station and (ii) that a few dead larvae may be found easily within the attacked leaves.

Jones describes the larva as cream-coloured; but I find it in colour between orange and umber. Jones states that the tubercles at the side of the body give rise to setae of six hairs each; I find nothing so regular, but a few hairs down the sides of the body. Jones states that the pupa is hairy; but it appears to me rather to have a coating of microscopic bristles. Except on these small points my observations agree with his; and I may conclude by quoting him, as I am convinced that the insect in Malacca is his. Jones states "This beetle belongs to the subfamily Hispinae of the family Chrysomelidae, which contains our worst leaf-eating beetles. There is little doubt that this species or representatives of this subfamily, occur in all coconut-growing countries. Frogatt reports a species of the family as being a most serious pest in the Solomon islands. The eggs are deposited singly on the underside of the leaflets and generally on the lower leaves of young palms.

The beetle eats a small hole through the lower epidermis of the leaf, leaving the edges of the hole very rough. The egg is inserted into this hole and cemented into place with a yellowish glutinous secretion which turns dark brown upon hardening, and resembles dried leaf tissue. The eggs are flat semielliptical brownish bodies, shaped somewhat like a pumpkin seed. The period of incubation of 286 eggs averaged 13.5 days, of which the maximum was 15 and the minimum 13. Upon hatching the larva eats its way through the egg-wall and directly into the tissue of the leaf, where it spends its entire larval and pupal stages. The larvae are fleshy footless grubs and average about 1.2 mm. in length when newly hatched. The head is the largest segment. The average length of the full-grown larva is 9.54 mm., and the average width of the head cast is 1.54 mm. The average time required in the larval stage is 32 days, twenty eight of these are spent in feeding, and four days without feeding during which time the larva changes into a pupa. During development, the larva feeds upon the parenchyma of the coconut leaf, and except when moulting it can be found at the end of the chamber opposite the egg. The larva eats in one direction only, leaving the old eggshell at the starting point. When moulting and changing into a pupa it recedes to the centre of its chamber. A characteristic habit of the larva is the deposition of its excrement in two rows one on each side of the excavated chamber. The average time occupied in the pupal stage is 7.3 days of which the maximum was twelve and the minimum five days. The pupa is orange-chrome or burnt sienna. The beetles vary from 7.5 to 10 mm. in length and are from 1.6 to 2 mm. in width. The beetles are sluggish and do not fly readily upon being disturbed. They rest by clinging slightly to the under side of the leaf, antennae extended forward, flat against the leaf. They crawl about promiscuously on the leaves of young coconuts and feed extensively upon the tissues between the veins of the leaflets. The injury has the appearance of a slight cut, but does not entirely penetrate the leaf. The injury done by the larva is greater than that of the adult, as a single larva will excavate a place in the leaf from 12 to 16 cm.* long and 1.5 to 3 cm.* wide. The tissue affected soon dies and becomes brown."

Jones, lastly writing of repressive measures suggests hand-picking by children; but so high are most of the attacked trees in Malacca that this is not to be thought of. The same difficulty attends the use of hydrocyanic gas. And indeed the only remedy seems to be promised by protecting or increasing the insect's natural enemies, for which purpose it would possibly be necessary to collect a supply in the Philippine islands.

By Professor C. F. Baker's kind offices, Dr. Gestro has seen specimens and confirms the determination.

I. H. Burkill.

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*There is a mistake on p. 130 of the Philippine Journal of Seince D. viii. in regard to the length of these tunnels, millimetres standing twice for centimetres. A reference to the plate there referred to proves it. Tunnels in Malacca are usually about 10 cm. long and 1 cm. wide; 3 cm. wide is excessive.

A BEETLE WHICH ATTACKS YAMS.

There is a beetle in Singapore of the genus *Lema* or *Criocera* which attacks yams.

Into the bulbils of *Dioscorea bulbifera* when mature it burrows to feed itself; and lives on the plants continuously and may often be seen "in cop." half in these burrows and half out. In the burrows the eggs are laid: they are of a pale yellow at first, but the colour darkens almost to horn-colour. So far as seen the eggs are not more than four or five in number in each group. They seem to take some time in hatching. The young grub is white with a black head and a small black mark just behind it. It has tiny hairs. When mature it is of a dull red and then it leaves the bulbil within which it has fed and presumedly burrows into the earth. The bulbil by this time is in Singapore a putrid mass, tunnelled all through.

So far no economic importance attaches to the insect, because it is only known to attack the aërial bulbils of *Dioscorea bulbifera* which, though eaten in India and Java and elsewhere, are not used in the Malay Peninsula.

I. H. BURKILL.

SOME TESTS OF GARDEN VEGETABLES IN SINGAPORE.

The Singapore markets are well supplied with the coarser garden vegetables: they afford fair carrots and beets, coarse sweet potatoes, a fair cruciferous substitute for the cabbage and abundance of the large and very rank Chinese radishes. Small but very good tomatoes are occasionally to be obtained. But certain features of the Chinese cultivation are abhorrent to the European; and he does not use these vegetables with any great zest, even after the most careful methods of cleansing that can be employed.

Most Europeans in Singapore maintain more or less spacious compounds, thus furnishing extraordinarily good opportunities for the establishing of home-gardens. Many have tried to do so, but rarely with any marked success: and moreover when in isolated instances success is achieved, the chance experimenter has forgotten the trade name of the seed which gave him the results, or has not got the name and address of the firm which produced that seed.

For in this matter it must be recognised that a great number of distinct varieties with accepted trade names have been isolated and established by expert horticulturists and are bred practically true for the trade, often through very considerable series of years. Of beans for instance, there are many hundreds on the seed-markets of the world now, and these differ remarkably in form, size, and colour of bean, in edibility of pod, in length of time to maturity and in reaction to soil, climate and disease. Some thrive best in the wet season, others in the drier time. Some prefer very light

soils; while others do very well on heavy soils. Some do as well in the Tropics, as in the temperate regions, while others succumb at once in the hot countries. Thus it may be readily seen that the prospective gardener in the Tropics can have failure after failure by the choice of races unsuited for his season and location, although the same races may be the most highly recommended for another country.

This is not only true for beans, but for all other crops. The solution of the difficulty is very simple, so simple in fact that the less progressive countries never give it the attention needed to secure the most certain results in the shortest time possible. This work in its simplest phase may all be included under the general head of *acclimatisation.* It is work full of the keenest interest, and pregnant with great economic possibilities. Planters and other public-spirited citizens have often not been content to await the laboured and usually long delayed action of government, although this is a natural government-function beyond the means of most private individuals. So we find acclimatisation societies scattered through the tropics and newer countries, which accomplish not a little by united effort and themselves profit by what is accomplished.

To accomplish the most definite and conclusive results, acclimatisation work must be thoroughly comprehensive; that is to say all varieties in the trade must be thoroughly tested on *all* kinds of soil, in *all* seasons, by *all* methods of culture, and in *all* parts of the country. The very variety which the experimenter overlooked, might be the very one to give the greatest success of all. A variety discarded as useless in a valley-plain has, in known cases, proved to be the greatest success in a near-by hill area. A variety neither specially well-known nor highly recommended in the country of its origin, has been found to give far better results under new conditions than some other varieties very highly recommended. Therefore if we are to determine the best bean-varieties for a new country, we must first obtain generous samples of absolutely *all* the varieties in the trade of Europe and of America, with special care to secure all of the varieties grown in the warmer parts of these regions. This will bring us into touch with such great seed-houses as Sutton in England, Vilmorin in France, Shortum, Burpee and Henderson in America. With abundant stocks in hand it then becomes a matter of good head-quarters facilities, wide co-operation and scientific exactness in the arrangement and control of all the work, and in the recording and dissemination of results. This says nothing of plant-breeding work, which naturally follows acclimatisation, and which is also full of the greatest economic possibilities.

It became possible in September, 1917, to put into operation a small preliminary series of acclimatisation trials in the Economic Garden in Singapore. Most countries involved in the Great War have been concentrating all possible energy on stimulating active interest in food crops; and an active and effective campaign in this direction possibly would not have cost the Government of the Settlements nearly so much as War allowances entail, such as have their

cause in the cost of importing food, and besides, the great value of such work would live on with increased significance into times of peace.

For the trials now to be described there was only a limited seed-stock which had been obtained from the College of Agriculture in the Philippines, by exchange, the original stock having come from the well-known seed-house of L. M. Shortum and Co., New York.

Radishes.

Nineteen varieties of the finest trade radishes were employed as follows:—

7121 Scarlet Tipped White Gem Forcing Radish.*
7107 White Strassburg Summer Radish.
7287 Half-long Delicacy Radish.
7124 Early Deep Scarlet Turnip Radish.
7122 Early Scarlet Globe-shaped Turnip Radish.
7276 Half-long White Forcing Radish.
7277 Olive-shaped Scarlet Radish.
7282
7114 Long Icicle Radish.
7113 Scarlet Chinese Winter Radish.
7111 Long Cincinnati Radish.
7116 Mammoth Tokyo Radish.
7118 Round Black Spanish Winter Radish.
7119 Early Non-Plus-Ultra Turnip Radish.
7283 Long Scarlet Short-top Radish.
7286 Olive-shaped White Forcing Radish.
7279 Golden Yellow Olive-shaped Radish.
7284 Half-long Deep Scarlet Radish.
7120 Early Scarlet Turnip-shaped Radish.

Beds of a light clay soil, such as is typical of Singapore, were thrown up upon a gently sloping hillside; a small amount of manure being thoroughly worked in. More would have been used, but was not available. The seed was planted in rows about eight inches apart, on September 8th, the area given to each variety averaging about one half square yard. The beds were kept clean weeded and the ground between the rows was occasionally stirred. Within four to six weeks several of the varieties gave supplies of good table radishes. Between October 16th and 24th:—

No. 7107 gave 18 ounces of cleaned radishes.
No. 7287 .. $21\frac{1}{2}$ .. .. ..
No. 7276 .. 10 .. .. ..
No. 7114 .. $11\frac{1}{4}$ .. .. ..

Nos. 7121, 7127, 7122 and 7277 did not return one half of the above yields, but produced a fair number of attractive table radishes, showing themselves worthy of a further trial at least on this soil and at this season.

*The numbers used are the serial culture number of the Philippines College of Agriculture.

Nos. 7111, 7113, 7116, 7118, 7119, 7279, 7283, 7286, 7284 and 7120 gave very poor results, mostly running to tops without any thickening of the roots. Nos. 7282 was a complete failure early in the test.

It should be understood distinctly that such a result does not condemn all the last named varieties for this country, but suggests that they are not suited for it under the seasonal conditions, the soil conditions and the method of treatment, combined, to which the plants were subjected; and one such trial is utterly insufficient to warrant a complete condemnation in any real acclimatisation work. Nevertheless the results are of interest and importance as far as they go, though all the trials should be greatly extended as to season and as to soil, and after the fuller trial the races may possibly show quite a different alignment as regards each other. It can only be said at present that with properly prepared beds and September planting, it is safe to use Nos. 7107, 7114, 7276 and 7287. Of course the ideal arrangement for both radishes and lettuces is a succession of small plantings running through the year and furnishing constant supplies for the table; but we are in no position yet to give specific advice concerning this.

Radishes are much attacked in the Straits by a small leaf folding larva; but it may be controlled easily by a Paris green spray made up in the proportion of one pound to fifty gallons of well limed water.

Lettuce.

Of lettuce, ten varieties were put on trial, as follows:—

7260 Wayahead Lettuce.
7250 White Summer Cabbage Lettuce.
7090 Philadelphia Dutch Butter Lettuce.
7262 Thorburn's Improved Big Boston Lettuce.
7256 White Paris Cos Lettuce.
7258 Giant Crystal Head Lettuce.
7096 New York Head Lettuce.
7086 Mignonette Lettuce.
7274 Deacon Lettuce.
7097 New Orchid Lettuce.

Lettuce cannot be planted directly in the prepared beds under our conditions, since the young plants are very delecate. Hence, the seed were sown in seed pans in burnt earth and lightly covered with clean white sand. Regular, moderate watering was given them. When the sprouted seedlings were large enough to handle, they were "pricked off" into boxes of rich earth spaced an inch and a half or two inches each way. These boxes were given plenty of sun but kept out of all heavy rain. When the plants were two or three inches high, they were set in beds prepared as for the radishes, the plants 4—6 inches distant in rows 8 inches apart. Frames of sticks were placed about the beds and ataps laid on the sloping tops. During the morning hours and in the evening hours these ataps were removed to give the plants plenty of sun.

The response of the lettuces to Singapore conditions was very interesting. Some varieties which in temperate regions make

dense heads of large leaves reverted to a condition akin to the wild form running up slender stems with scattered widely separated leaves; such were Nos. 7250, 7090, 7262 and 7256. Two of the varieties 7258 and 7096 while somewhat leggy gave very good leaves. No. 7086 proved to be a thoroughly good lettuce for Singapore, yielding more than four pounds of first class bunches from five square yards of soil. No. 7274 turned out to be in Singapore a very delicate small smooth leaved lettuce, quite fair for Singapore. No. 7097 is a very peculiar lettuce, having leaves speckled with pale brown. It runs somewhat to stems but produces fair leaves. No. 7260 made a fairly good bunch, of large smooth leaves. Therefore, for this season and soil, Nos. 7086 and 7260 may be used with assurance of obtaining good results. The remainder should be given a further trial.

Tomatoes.

Tomatoes are the most tender plants of the garden and the most difficult to handle successfully. They are extremely susceptible to disease, especially to the so-called "solanaceous wilt" which is widely spread in the tropics and also affects tobacco and some other plants. Most old garden soils are infected with the organisms of this wilt disease. Therefore, for surest success with tomatoes, we must use either virgin soil, or a soil thoroughly sterilized by burning, by steam, or by boiling water. Also tomatoes thrive better on well-manured well-drained light sandy loams than on heavy or soggy soils. All of these well-known facts came out clearly in the course of the trials, here described.

The young plants were handled in the same way as lettuce. They were then divided into lots and planted in a variety of situations and on a variety of soils. Facilities were lacking for sterilising any considerable amount of soil; and labour was lacking for opening up new ground. The plants put out, whatever their variety, on the heavy soggy soils or on the old soils were soon destroyed by wilt. However on one small part of the garden there exist a few well-raised beds of very sandy soil; and on these beds when well-manured, three out of the many varieties developed rapidly into strong plants, only a few among them dying from wilt. On some beds nearby but less sandy, No. 7173 (Early Ruby Tomato) developed far enough to set large good tomatoes before it succumbed to wilt. The varieties which showed the greatest resistance to wilt and the readiest adaptability to the Singapore conditions at the season of their testing were No. 7169 (Buckeye State) and 7146 (Perfection). It seems certain that fine results may be obtained with these two if proper methods are used. While the facilities available did not permit of the trial being properly carried out on a garden scale, interesting result were got on using pots filled with prepared soil. Among these are pot-grown plants there was very much less wilt and at the time of writing they are setting healthy young tomatoes.*

*It is not recorded how many fruits they gave, but No. 7160 gave one fruit weighing $2\frac{3}{4}$ oz.; two fruits of No. 7176 weighed together $2\frac{1}{2}$ oz, two of 7173 weighed together $2\frac{1}{4}$ and three of 7147 weighed together $5\frac{1}{2}$ oz., which figures indicate the size. I.H.B.

From the whole series of experiments it is evident that comprehensive trials with varieties of tomatoes would soon lead to very practical results.

Garden Beans.

Coarse beans of various sorts can be obtained almost anywhere in the tropics, but the finer garden beans of temperate regions, such as the Butter and Wax beans and French limas, are usually conspicuous by their absence. We have had remarkable success with certain varieties from each of these types. In the short time available, we were dependent on those which it was possible to obtain from the Philippine College of Agriculture; and these included.

7194 Kentucky Wonder Pale Bean.
7212 Carpenteria Pale Bean.
7205 Kentucky Wonder Golden Wax Bean.
7197 Currier's Rust Proof Bean.
7211 Henderson's Bush Lima.
7210 Siebert's Early Lima.
7207 Giant polded Lima.
7209 Wood's Prolific Lima.
7208 Jackson Wonder Bush Lima.
7192 Pencil-pod Black Wax Bean.
7191 Black German Wax Bean.
7206 Fordham Bean.

Most of these varieties have grown with great vigor on our old garden soils. But No. 7209 turned out to be a poor grower and yielder: and Nos. 7191 and 7192 were practical failures, being poor growers, becoming badly blighted and producing but few pods. The remainder, all successful, can be divided into two groups, the very early, and the very late. Among the latter are Nos. 7212, 7210, 7207, 7208 and 7206. These have all grown well but have not come to cropping at this time.§ No. 7194 grows well, and gives a good early crop of large green snap beans. No. 7205 is a strong grower and produces a large early crop of very large yellow wax beans. No. 7197 produces yellow snap beans on a low bushy plant. Here it is the earliest of all, giving, within a few weeks, an abundant crop of fine yellow wax beans, and dying off rapidly as soon as the crop is made. No. 7211 is a rapid grower, and gives a quick and abundant crop of fine small limas.

Therefore, for quick results in two distinct types Nos. 7197 and 7211 are to be considered first choice. But the other varieties mentioned above can be used to good advantage. By this use of diverse varieties, together with successive plantings, the Singapore resident will probably have no difficulty in obtaining good supplies of the finest garden beans throughout the year. Since this is a matter of great economic importance to the whole people, these trials should be continued and on a more comprehensive scale.

§ The crop matured by the late races was insignificant, and the pods were not well filled. E.H.M.

Soy Bean.

The Soy bean is of enormous importance in Japan, Manchuria and China; and thence a great feature in world commerce. It is now being extensively planted in the United States. It has been said that it could not be grown in the Tropics, and some first trials of it in the Philippines a few years ago led to statements that it could not be successfully grown there. However this was merely a case of the wrong variety for the season in which the planting was done; for there are many distinct varieties of Soy of quite different possibilities; and more comprehensive trials in the Philippine islands developed the fact that certain varieties were suited only to the wet season, others only to a drier period, and some were heavier yielders of hay, others of grain, and so on, it now being recognized that soy is a practicable crop for the country.

Three varieties were brought to Singapore from the Philippines. Two did not germinate. The third gave but few plants, but these grew well and are now setting pods. Great care should be taken to continue and develop this culture† since out of it may arise a real asset to the country. Comprehensive trials of all the soys should certainly be carried out here. The great value of the plant in furnishing direct food for man and beast is but a part of its value, since its secondary products are used the world over. Vast quantities of the famous soy sauce* are consumed yearly in all parts of the world, while bean curds and oil from this source are well known.

Peanuts.

The common peanuts of the Singapore market are small and of the Spanish type. There are a number of varieties in other countries which yield far larger nuts, better for direct eating, though some of these do not give larger total yields under similar conditions, nor larger oil percentages than the small Spanish peanuts. Four varieties were used in the trials under description, viz., San Mateo, Montalban, American and Kinorales, all of which have been grown with success in the Philippines. These were planted in beds similar to the varieties of Radish as described above, there being seed only for five square yards of each variety. The seed Kinorales proved to be bad, the bed yielding but one plant, which, however, as also all plants of the other varieties, grew with great vigor. The seed was put in on August 1st and the crop harvested fifteen weeks later. As the plants were ripening off, the leaves became spotted with the common fungus *Cercospora personata*, which, luckily, rarely attacks the plant in its prime. The yields of shelled dried nuts were as follows:

San Mateo	.. ..	23 oz.
Montalban	.. ..	26½ oz.
American	.. ..	22¾ oz.

† The second crop of Soy bean was for some unknown reason a complete failure. E.H.M.

* Basis also for one of the best known English table sauces.

This seed as well as that produced by the one plant of Kinorales, will be immediately replanted to increase the stock.*

Yautias.

Many varieties of this important tropical root crop, yielded by *Xanthosoma sagittifolium* and *X. violaceum,* are grown in the American Tropics. In Cuba under the name of "malangas" they are standard vegetables. In some respect the yautias resemble the gabis (kladi) produced by *Colocasia antiquorum.* But they are better yielders and produce a vegetable better relished by Europeans, since they lack the slimness of the gabi after cooking; also they can be grown with greater success as a field crop in fields high and dry enough to be readily plowed and cultivated by bullocks. They appear not to be susceptible to the very injurious colocasia mildew which disease is widely distributed in the orient. Nine distinct varieties have been introduced from the Philippines and are now well advanced in growth, as follows:

588 (unnamed).
444 Rolliza.
309 Rolliza blanca.
439 Trinidad Yellow.
586 (unnamed).
443 Grey Jack.
441 Mi Senora.
1521 San Fernando Po.
440 Prieta.

The history of the parents of this stock is as follows:—a series of varieties were brought to California from Porto Rico and carried through one generation after which they were taken to the Philippines where they have been very successfully carried through a number of generations. Our present stock was selected from these Philippine cultures.

The Gardens formerly possessed one variety of *Xanthosoma sagittifolium* and a very robust variety of *Alocasia antiquorum* (Kladi udang). The latter since it possesses an abundance of runners belongs to the group of varieties known as Dasheens. This plant not only furnishes tubercles, and a good pot herb (the youngest tenderest leaves), but the runners can be covered and bleached and make a very fair substitute for asparagus. The new introductions will be put out in beds alongside the two previously planted varieties, so that complete comparisons will be possible within ten months, when the crop is ready. These plants should be multiplied and generally disseminated through the colony.

The dasheens furnish three types of planting stock, runners, side sprouts and trunk tops, hence beds of the Kladi Udang mentioned above, have been separately planted with these in the present cultures in order to determine any possible difference in length of time to maturity or in final yield. C. F. Baker.

* Except the San Mateo Pea nut, none of the races in the second planting gave results worth recording. San Mateo grew well although planted in rather unsuitable soil; and produced plenty of well filled large pods. But thieves mice and squirrels got at them, and when the bed was dug the results did not represent the produce. It is being replanted. E.H.M.

Host Index.

for

Penzig's and Saccardo's, Icones Fungorum Javanicorum Diagnoses Fungorum in insula Java Collectorum and Raciborski's, Parasitische Algen und Pilze Javas.

Acacia—dead limbs.
    Botryodiplodia acacigena, Penz. et Sacc.
Acacia—on Diplodia on.
    Nectria episphaerioides, Penz. et Sacc.
Acer laurinum.
    Criella aceris-laurini, (Pat.) Sacc. & Syd.
    Nymanomyces aceris-laurini, (Pat.) Henn.
    Parodiella aceris, Rac.
    Schizothyrium aceris, (Henn. & Lind.) Pat.
    Synglonium insigne, Penz. et Sacc.
Achyranthes.
    Cystopus bliti, (Riv.) de Bary.
Acorus terrestris.
    Uredo acori, Rac.
Acrocomia sclerocarpa.
    Winterella eutypoides, Penz. et Sacc.
Acronodia punctata.
    Aecidium puspa, Rac.
    Asterina alpina, Rac.
Acrostichum (Elaphoglossum) *callaefolium.*
    Scolecopeltis salacensis, Rac.
Adhatoda vasica.
    Oidium tabaci, Thuem.
Agaric.
    Spicaria elegans, (Corda) Harz.
Alsophila contaminans.
    Hysterostomella contaminans.
Alsophila—dead petioles.
    Dasyscypha javanica, Penz. et Sacc.
Amonius.
    Hypocrella discoidea, (B. & Br.) Sacc.
Antidesma bunius.
    Uredo antidesmae, Rac.
Antidesma dioica.
    Uredo antidesmae-dioicae, Rac.
Antidesma heterophylla.
    Elsinoe antidesmae, Rac.
Arachis hypogaea.
    Septogloeum arachidis, Rac.
Araliaceae—leaves.
    Sphaerella longispora, Penz. et Sacc.
Araneae.
    Gibellula phialobasia, Penz. et Sacc.

Arenga saccharifera.
Auerswaldia arengae, Rac.
Graphiola arengae, Rac.
Arthrophyllum—dead petioles.
Diplodia arthrophylli, Penz. et Sacc.
Artocarpus incisa.
Rhizopus artocarpi, Rac.
Arundina speciosa.
Caeoma arundinae, Rac.
Arundinaria.
Uredo arundinariae, Sydow.
Arundinaria—young twigs.
Konradia bambusina, Rac.
Asplenium pallidum.
Hymenoscypha asplenii, Rac.
Bambusa.
Didymosphaeria polysticta, (B. & C.) Sacc.
Hymenopsis ellipsospora, (Fuck.) Sacc.
Konradia secunda, Rac.
Bambusa—dead.
Acerbia culmigena, Penz. & Sacc.
Astrocystis mirabilis, B. & Br.
Campsotrichum elegans, Penz. & Sacc.
Chaetosphaeria silva-nigra, Penz. & Sacc.
Comosporium bambusae, Thuem.
Didymella maculosa, Penz. & Sacc.
Didymosphaeria fusispora, Penz. & Sacc.
Didymosphaeria minutella, Penz. & Sacc.
Didymosphaeria striatula, Penz. & Sacc.
Erinella albida, Penz. & Sacc.
Erinella tomentella, Penz. & Sacc.
Eutypa bambusina, Penz. & Sacc.
Harpographium nematosporum, Penz. & Sacc.
Helicosporium intermedium, Penz. & Sacc.
Helotiella myoleuca, Penz. & Sacc.
Heteronectria spirillispora, Penz. & Sacc.
Melanconium sphaerospermum, (Pers.) Lk. subsp. bambusarum, Penz. & Sacc.
Melanomma tornatum, Sacc. & Paol.
Melanomma trochus, Penz. & Sacc.
Melanopsamma patellata, Penz. & Sacc.
Nectria vulgaris, Speg.
Nummularia minutula, Penz. & Sacc.
Ophiobolus javanicus, Penz. & Sacc.
Podosporium tjibodense, Penz. & Sacc.
Pteridospora javanica, Penz. & Sacc.
Rosellinia formosa, Penz. & Sacc., var. flavozonata, Penz. & Sacc.
Scirrhia bumbusina, Penz. & Sacc.
Stilbum longipes, Penz. & Sacc.
Tubeufia javanica, Penz. & Sacc.
Winteria oxyspora, Penz. & Sacc.

Bambusa—dead sheaths.
Clithris arundinacea, Penz. & Sacc.
Rosellinia decipiens, Penz. & Sacc.
Septoria phlyctaenoides, Penz. & Sacc.
Bambusa—living leaves.
Epichloe bambusae, Pat.
Bambusa—young twigs.
Konradia bambusina, Rac.
Bambusa blumeana (Schizostachyum).
Mendogia bambusina, Rac.
Bark—dead.
Amallospora Dacrydion, Penz.
Botrytis monilioides, Penz. & Sacc.
Chilonectria javanica, Penz. & Sacc.
Coryne javanica, Penz. & Sacc.
Cylindrocolla succinea, Penz. & Sacc.
Dendrochium javanicum, Penz. & Sacc.
Haplosporella bogoriensis, Penz. & Sacc.
Helminthosporium gigantosporum, B. & Br. subsp. javanicum, Penz. & Sacc.
Helotium subserotinum, Henn. & Nym.
Humaria umbilicata, Penz. & Sacc.
Hypocrea discolor, Penz. & Sacc.
Hypoxylon annulatum, (Schw.) Mont.
Hypoxylon discophorum, Penz. & Sacc.
Hypoxylon microcarpum, Penz. & Sacc.
Hypoxylon perforatum, (Schw.) Sacc.
Hypoxylon polyspermum, Mont.
Kretzschmaria gomphoidea, Penz. & Sacc.
Lachnea longiseta, Penz. & Sacc.
Nectria ambigua, Penz. & Sacc., var pallens, Penz. & Sacc.
Nectria carneoflavida, Penz. & Sacc.
Nectria coccinea, (Pers.) Fr.
Nectria coronata, Penz. & Sacc.
Nectria nigella, Penz. & Sacc.
Nectria tjibodensis, Penz. & Sacc.
Nectria trachycarpa, Penz. & Sacc.
Nummularia discolor, (Berk.) Ellis.
Nummularia uni-apiculata, Penz. & Sacc.
Oedocephalum macrosporium, Penz. & Sacc.
Ophionectria trichospora, (B. & Br.) Sacc.
Patinella chlorosplenioides, Penz. & Sacc.
Patouillardiella javanica, Penz. & Sacc.
Penzigia macrospora, Penz. & Sacc.
Pezizella convexella, Penz. & Sacc.
Pezizella subceracella, Penz. & Sacc.
Pilacre Petersii, Berk. & Curt.
Physospora spiralis, Penz. & Sacc.
Podosphaeria casuarinae, Penz. & Sacc.
Rhytidhysterium guaraniticum, Speg. subsp. javanicum, Penz. & Sacc.
Sphaeronemella macrospora, Penz. & Sacc.

Sporocybe apiculata, Penz. & Sacc.
Stilbum minutulum, Penz. & Sacc.
Stilbum pallidulum, Penz. & Sacc.
Tympanopsis coelosphaeroides, Penz. & Sacc.
Volutina concentrica, Penz. & Sacc.
Xylaria haemorrhoidalis, B. & Br.
Xylaria pilaeformis, Berk. & Curt.
Xylaria trichopoda, Penz. & Sacc.
Zythia abnormis, Penz. & Sacc.

Bark—living.
Antennaria scoriadia, Berk.
Erinella bogoriensis, Henn. et Nym. subsp. candida, Penz. & Sacc.
Pellionella deformans, Penz. & Sacc.
Stilbum ochroleucum, Penz. & Sacc.

Bixa orellana.
Ovularia bixae, Rac.

Blechnum orientale.
Irydyonia filicis, Rac.

Botryodiplodia longipes.
Botrytis monilioides, Penz. & Sacc.

Branches—see limbs.

Calamus.
Graphiola macrospora, Penz. & Sacc.
Morenoella calami, Rac.
Morenoella gedeana, Rac. var. calamicaba, Rac.
Phymatosphaeria calamis, Rac.

Calamus—dead leaves.
Erinella nivea, Penz. & Sacc.

Calamus—dead sheaths.
Pezizella avellana, Penz. & Sacc. var. macrospora, Penz & Sacc.

Camellia japonica.
Laestadia theae, Rac.

Canarium commune.
Skierkia canarii, Rac.

Canavalia gladiata.
Elsinoe canavaliae, Rac.

Canna sp.
Uredo cannae, Wint.

Canthium.
Balladyna gardeniae, Rac.

Carica papaya—branches.
Diplodia papayae, Thuem.

Caryophyllus aromaticus.
Trametes caryophylli, Rac.

Caryota—dead leaves.
Exosporium megalosporium, Penz. & Sacc.

Caryota propinqua.
Diplodiella caryotae, Rac.

Castanea vesca.
Pestalozzia monochaeta, Desm.

Castanopsis—spines of rotten fruits.
Lanzia reticulata, Penz. & Sacc.
Phialea glaucescens, Penz. & Sacc.
Cecropia schiedeana—rotten wood.
Anthromycopsis broussonetiae, Pat. et Trab. subsp. minor, Penz. & Sacc.
Cercocoma macrantha.
Uredo chonemorphae, Rac.
Chlamydomonas pluvialis.
Polyphagus nowakowskii, Rac.
Chonemorpha macrophylla.
Uredo chonemorphae, Rac.
Cinnamomum zeylanicum.
Aecidium cinnamonii, Rac.
Scolecotrichum cinnamonii, Rac.
Clerodendron blumeanum.
Caeoma clerodendri, Rac.
Clerodendron fragrans.
Caeoma clerodendri, Rac.
Coccids—on coriaceous leaves.
Aschersonia javanica, Penz. & Sacc.
Cocos nucifera.
Pestalozzia palmarum, Cooke.
Coix lacryma-jobi.
Phyllachora coicis, Henn.
Ustilago coicis, Rac.
Coleoptera—larva.
Cordyceps citrea, Penz. & Sacc.
Cordyceps obtusa, Penz. & Sacc.
Coleoptera—pupa.
Cordyceps coccinea, Penz. & Sacc.
Colocasia esculenta.
Phytophthora colocasiae, Rac.
Connarus diversifolia.
Stagonospora disseminata, Rac.
Corypha gebanga—dead leaves.
Bonordeniella memoranda, Penz. & Sacc.
Cucurbita.
Oidium tabaci, Thuem.
Culms.
Neopeckia pumila, Penz. & Sacc.
Culms—dead (see stems).
Boerlagella laxa, Penz. & Sacc.
Chromosporium pallens, Penz. et Sacc.
Hypocrea gelatinosa, (Tode.) Fr.
Ophioceras dolichostomum, (B. & C.) Sacc.
Culms—grass.
Torula glomerulosa, Penz. & Sacc.
Curculigo latifolia.
Didymosphaeria impar, Penz. et Sacc.
Puccinia curculigo, Rac.

Curculigo recurvata.
Puccinia curculigo, Rac.
Cyathea orientalis.
Asterina cyathearum, Rac.
Dendrophthora pentandra.
Puccinia macrocarya, Rac.
Derris.
Puccinia periodica, Rac.
Derris elliptica.
Cryptomyces pongamiae, (B. & Br.)
Triphragmium pulchrum, Rac.
Dianella javanica.
Uredo dianellae, Rac.
Dinochloa tjankorreh.
Mindogia bambusina, Rac.
Phyllachora tjankorreh, Rac.
Desmodium umbellatum.
Cercosporella atropunctata, Rac.
Dioscorea aculeata.
Uredo dioscoreae-aculeatae, Rac.
Dioscorea alata.
Cercospora ubi, Rac.
Uredo dioscoreae-alatae, Rac.
Dioscorea filiformis.
Uredo dioscoreae-filiformidis, Rac.
Diospyros.
Aecidium rhytismoides, Rac.
Diospyros—seeds.
Aspergillus penicillopsis, (Henn. & Nym.), Rac.
Diplodia—on Acacia.
Nectria episphaerioides, Penz. & Sacc.
Dung—buffalo.
Ascobolus latus, Penz. et Sacc.
Saccobolus kerverni, (Cr.) Boud.
Earth.
Barlaeina albo-coerulescens, Penz. & Sacc.
Barlaeina connexella, Sacc. subsp. tjibodensis, Penz. & Sacc.
Helvella lacunosa, Afz. subsp. javanica, Penz. & Sacc.
Lachnea longiseta, Penz. & Sacc.
Peziza citrina, Penz. & Sacc.
Peziza sparassiformis, Henn.
Phaeomacropus fleicherianus, Henn.
Podocrea cordyceps, Penz. & Sacc.
Eichornia crassipes.
Pachysterigma grisea, Rac.
Elaeagnus latifolius.
Aecidium elaeagni, Rac.
Elaeocarpus augustifolius.
Dothidella elaeocarpi, Rac.
Elettaria.
Phyllachora elettariae, Pat.

Schroeteriaster elettariae, Rac.
Trichosporium olivastrum, Sacc.
Elettaria—dead.
Hypocrella discoidea, (B. & Br.) Sacc.
Montoniella polita, Penz. & Sacc.
Orbilia neglecta, Penz. & Sacc.
Elettaria—dead leaves.
Ceuthocarpon tjibodense, Penz. & Sacc.
Cryptothecium javanicum, Penz. & Sacc.
Lophodermium javanicum, Penz. & Sacc.
Oxyspora carneola, Sacc.
Trichopeziza porioides, Penz. & Sacc.
Xenosporium mirabile, Penz. & Sacc.
Elettaria—dead stems.
Acanthostigma nectrioideum, Penz. & Sacc.
Bactrosphaeria asterostoma, Penz. & Sacc.
Botrytis vulgaris, Fr.
Ceratostomella polyrrhyncha, Penz. & Sacc.
Ciliciopodium macroporum, Penz. & Sacc.
Diaporthe javanica, Penz. & Sacc.
Helotiella aurea, Penz. & Sacc.
Melchioria leucomelaena, Penz. & Sacc.
Nectria albo-fimbriata, Penz. & Sacc.
Nectria dolichospora, Penz. & Sacc.
Nectria raripila, Penz. & Sacc.
Nectriella rufo-fusca, Penz. & Sacc.
Nectriella setulosa, Penz. & Sacc.
Pezizella armeniaca, Penz. & Sacc.
Pezizella tjibodensis, Penz. & Sacc.
Phlyctaena variabilis, Penz. & Sacc.
Rhabdospora elettariae, Penz. & Sacc.
Rosellinia formosa, Penz. & Sacc.
Tubeufia coronata, Penz. & Sacc.
Zignoella acervata, Penz. & Sacc.
Zignoella interspersa, Penz. & Sacc.
Elettaria—on Melchioria on.
Nectriella pallidula, Penz. & Sacc.
Entada—dead leaves.
Stegia nitens, Penz. & Sacc.
Equisetum debile.
Stamnaria equiseti, (Hoffm.) Sacc.
Eriodendron anfractuosum.
Ramularia eriodendri, Rac.
Erythrina lithosperma.
Telimena erythrinae, Rac.
Eugenia (Jambosa) *aquea.*
Haplosporella dendritica, Rac.
Eugenia or *Ficus.*
Meliola octospora, Cooke.
Eutypa heteracantha.
Mollisia obconica, Penz. & Sacc.
Ficus. (See also Eugenia).
Hyalodothis incrustans, Rac.

Ficus hispida.
Phyllachora marmorata, Rac.
Ficus leucanthoma.
Phyllachora decaisneana, (Lev.) Sacc.
Filices—dead leaves.
Helotium pteridophilum, Penz. & Sacc.
Filices—dead petioles of tree ferns.
Delpontia pulchella, Penz. & Sacc.
Flemingia lineata.
Parodiella perisporioides, (B. & C.) Speg.
Freycinetia imbricata.
Uredo freycinetiae, Rac.
Fruit—dead rind.
Stilbum fructigenum, Penz. & Sacc.
Vermicularia longiseta, Penz. & Sacc.
Garcinia purpurea—bark.
Pellionella deformans, Penz. & Sacc.
Gardenia lucida.
Balladyna gardeniae, Rac.
Geophila reniformis.
Puccinia geophilae, Rac.
Gossypium herbaceum.
Uredo gossypii, Lag.
Grass culms. See *Culms.*
Torula glomerulosa, Penz. & Sacc.
Griffithia fragrans.
Endophyllum griffithiae, Rac.
Heliotropium.
Oidium tabaci, Thuem.
Helminthosporium—on Elettaria.
Rhabdospora elettariae, Penz. & Sacc.
Heptapleurum.
Triphragmium thwaitesii, B. & Br.
Hibiscus tiliaceus.
Physalospora hibisci, Rac.
Hydrocotyle.
Stigmatea hydrocotyles, Rac.
Hymenoptera—head.
Cordyceps lachnopoda, Penz. & Sacc.
Imperata arundinacea.
Micropeltis alang-alang, Rac.
Inocarpus edulis.
Uromyces inocarpi, Rac.
Insect excrement.
Isaria thyrsoidea, Penz. & Sacc.
Insects. (See also *Coccids, Coleoptera, Hymenoptera, Lamellicorn, Larva, Leaves, Coccids on; Lepidoptera, Mosquitoes, Termites, Vespa*).
Isaria thyrsoidea, Penz. & Sacc.
Ipomoea.
Meliola quadrispina, Rac.

Ipomoea batatas.
Ramularia batatae, Rac.
Ipomoea pes-caprae.
Aecidium ipomoeae, Thuem.
Ipomoea turpethum.
Cystopus convolvulacearum, Otth.
Justicia gendarussa.
Puccinia thwaitesii, B. & Br.
Kentia—dead leaves.
Anthostomella grandispora, Penz. & Sacc.
Kentia.
Pestalozzia funerea, Desm.
Korthalsia—dead petioles.
Phaeodiscula gonospora, Penz. & Sacc. subsp. atrata, Penz. & Sacc.
Lamellicorn—larva.
Cordyceps citrea, Penz. & Sacc.
Lasianthus.
Gibellina concentrica, Rac.
Lasianthus latifolius.
Coccomyces tjibodensis, Rac.
Larva.
Botrytis tenella, Sacc.
Cordyceps fleischeri, Penz. & Sacc.
Isaria alborosea, Penz. & Sacc.
Lauracea—leaves.
Laestadia veneta, Sacc. & Speg.
Leaves—living.
Hypocrella scutata, (Cooke) Sacc.
Pestalozzia leucodisca, Penz. & Sacc.
Sphaerella creberrima, Penz. & Sacc.
Trichosporium arborescens, Penz. & Sacc.
Triphragmium thwaitesii, B. & Br.
Leaves—coriaceous and subcoriaceous.
Botryosphaeria phyllachoroides, Penz. & Sacc.
Ceuthocarpon depōkense, Penz. & Sacc.
Erikssonia pulchella, Penz. & Sacc.
Gloeosporium anceps, Penz. & Sacc.
Lembosia diffusa, Wint. subsp. breviuscula, Penz. & Sacc.
Linospora capillaris, Penz. & Sacc.
Lophodermium maculare, (Fr.) de Not.
Micropeltis leucoptera, Penz. & Sacc.
Micropeltis macropelta, Penz. & Sacc.
Pestalozzia leucodisca, Penz. & Sacc.
Rinia spectabilis, Penz. & Sacc.
Venturia euchaeta, Penz. & Sacc.
Leaves—coriaceous—coccids on.
Aschersonia javanica, Penz. & Sacc.
Leaves—coriaceous—dead.
Coccomyces dentatus, Sacc. var. hexagona, Penz. & Sacc.
Dasyscypha albidula, Penz. & Sacc.

Patinella phyllogena, Penz. & Sacc.
Sordaria tjibodiana, Penz. & Sacc.

Leaves—dead.
Actiniceps thwaitesii, B. & Br.
Isaria thyrsoidea, Penz. & Sacc.
Xylaria aristata, Mont.

Leguminosa—leaves.
Parodiella perisporioides, (B. & C.) Speg.

Leguminosa—pods.
Xylaria heloidea, Penz. & Sacc.

Lepidoptera—larva.
Cordyceps atro-brunnea, Penz. & Sacc.
Cordyceps coccinea, Penz. & Sacc., subsp. subochracea, Penz. & Sacc.
Cordyceps deflectens, Penz. & Sacc.
Isaria alborosea, Penz. & Sacc.

Lespedeza cytisoides.
Woroninella vulcanica, Rac.

Leucoxylon—seeds.
Aspergillus penicillopsis, (Henn. & Nym.) Rac.

Lichenes.
Gliocladium pulchellum, Penz. & Sacc.

Limbs—dead.
Anthostoma valsarioides, Penz. & Sacc.
Anthostoma verrucula, Penz. & Sacc.
Arthrosporium tenue, Penz. & Sacc.
Belonidium tabacinum, Penz. & Sacc.
Botryodiplodia longipes, Penz. & Sacc.
Cephalothecium roseum, Corda.
Cladotrichum socium, Penz. & Sacc.
Cylindrum fugax, Penz. & Sacc.
Dasyscypha isabellina, Penz. & Sacc.
Dasyscypha ochrolenca, Penz. & Sacc.
Davincia helios, Penz. & Sacc.
Diatrype princeps, Penz. & Sacc.
Enchnoa chaetomioides, Penz. & Sacc.
Erinella carneola, Penz. & Sacc.
Erinella citrino-alba, Penz. & Sacc.
Eutypa heterantha, Sacc.
Graphium desmazierii, Sacc.
Helotium subserotinum, P. Henn. & Nym.
Hymenula inaequalis, Penz. & Sacc.
Hymenula tjibodensis, Penz. & Sacc.
Hypocrea catoptron, B. & Br.
Hypocrea fulva, Penz. & Sacc.
Hypocrea gelatinosa, Fr. subsp. oligotheca, Penz. & Sacc.
Hypocrea longicollis, Penz. & Sacc.
Hypocrea pulchella, Penz. & Sacc.
Hypoxylon annulatum, (Schw.) Mont.
Hypoxylon anthracoderma, Speg.
Hypoxylon microsorum, Penz. & Sacc.
Hypoxylon rubellum, Penz. & Sacc.

Hysteriographium oligomerum, Penz. & Sacc.
Karschia nigerrima, Sacc. subsp. globuligera, Penz. & Sacc.
Lophodermium hypodermoides, Penz. & Sacc.
Megalonectria pseudotrichia, (Schw.) Speg.
Nectria ambigua, Penz. & Sacc.
Nectria coronata, Penz. & Sacc.
Nectria eustoma, Penz. & Sacc.
Nectria leucotricha, Penz. & Sacc.
Nectria radians, Penz. & Sacc.
Nectria vulgaris, Speg.
Nectria xanthostroma, Penz. & Sacc.
Nectriella aurantia, Penz. & Sacc.
Neopeckia diffusa, (Schw.) Starb.
Neopeckia pumila, Penz. & Sacc.
Ophioceras dolichostomum, (B. & C.) Sacc.
Ophioceras majusculum, Penz. & Sacc.
Patellaria callispora, Penz. & Sacc.
Patinella chlorosplenoides, Penz. & Sacc.
Pezizella glaberrima, Penz. & Sacc.
Rhynchostoma rhytidosporum, Penz. & Sacc.
Rosellinia beccariana, Ces.
Rosellinia bunodes, (B. & Br.) Sacc.
Rosellinia obtusispora, Penz. & Sacc.
Rosellinia pulvis-pyrius, Penz. & Sacc.
Sordaria botryosa, Penz. & Sacc.
Stictis pallidula, Sacc.
Stilbum cinnabarinum, Mont.
Stilbum minutulum, Penz. & Sacc.
Stilbum parviceps, Penz. & Sacc.
Thuemenella javanica, Penz. & Sacc.
Torula heteromorpha, Penz. & Sacc.
Trichosphaeria proxima, Penz. & Sacc.
Trinacrium subtile, Riess, subsp. tjibodiense, Penz. & Sacc.
Tubeufia anceps, Penz. & Sacc.
Valvaria massarioides, Penz. & Sacc.
Vermicularia longiseta, Penz. & Sacc.
Xylaria aristata, Mont.
Xylaria humilis, Penz. & Sacc.
Xylaria oocephala, Penz. & Sacc.

Limbs—living.
Fleischeria javanica, Penz. & Sacc.

Liquidambar sp.?—
Astrosporium chrysocephalum, Penz. & Sacc.

Litsea chrysocoma.
Phyllachora laurinearum, Rac.

Livistona olivaeformis—dead bark.
Zignoella omphalostoma, Penz. & Sacc.

Lonicera—leaves.
Criella lonicerae, Henn.

Mallotus moluccanus.
Cronartium malloti, Rac.

Mangifera indica.
Gloeosporium mangiferae, Rac.
Mangifera kemanga.
Cronartium kemangae, Rac.
Mapania.
Puccinia mapaniae, Rac.
Marattia sambucina.
Morenoella marattiae, Rac.
Melchioria—on Elettaria.
Nectriella pallidula, Penz. & Sacc.
Melocanna.
Konradia secunda, Rac.
Menispermaceae—dead leaves.
Acrospermum foliicolum, Berk.
Metroxylum longispinum—bark.
Lophiosphaeria schizostoma (Mont.) Trev.
Michelia velutina.
Goplana micheliae, Rac.
Scolecopeltis salacensis, Rac.
Monocot—dead bark.
Nectria hypoxantha, Penz. & Sacc.
Calonectria effugiens, Penz. & Sacc.
Monocot—leaves.
Myiocopron affine, Penz. & Sacc.
Monocot—dead leaves.
Cladotrichum mitratum, Penz. & Sacc.
Stilbum candidulum, Penz. & Sacc.
Monocot—dead stems.
Calonectria callorioides, Penz. & Sacc.
Mollisia orbilioides, Penz. & Sacc.
Mosquitoes.
Empusa grylli, (Fres.) Now.
Mucuna.
Parodiella mucunae, Rac.
Uromyces? mucunae, Rabenh.
Musci.
Gliocladium pulchellum, Penz. & Sacc.
Pezizella epibrya, Penz. & Sacc.
Myrica javanica.
Myxosporium candidissimum, Rac.
Myrsine affinis.
Epichloe montana, Rac.
Nephrodium heterophyllum.
Morenoella nephrodii, Rac.
Nephrolepis acuta.
Entyloma nephrolepidis, Rac.
Lembosia longissima, Rac.
Nicotiana tabacum.
Cercospora nicotianae, E. & E.
Phytophthora nicotianae, de Haan.
Pythium complens, Fischer.
Pythium vexans, De Bary.

Nipa fruticans.
Lembosia javanica, (Pat.) Rac.
Oryza sativa.
Napicladium janseanum, Rac.
Ustilaginoidea virens, (Cooke) Tak.
Palm—dead leaves.
Pezizella avellanea, Penz. & Sacc.
Trichobotrys pannosa, Penz. & Sacc.
Palm—dead petioles.
Anthostomella obtusispora, Penz. & Sacc.
Arenaea javanica, Penz. & Sacc.
Arenaea macrospora, Penz. & Sacc.
Aulographum atromaculans, Penz. & Sacc.
Anthostomella obtusispora, Penz. et Sacc.
Davincia tenella, Penz. & Sacc.
Didymobotrium atrum, Pat. var. pachysporum, Penz. & Sacc.
Helminthosporium nodipes, Penz. & Sacc.
Illosporium aureolum, Penz. & Sacc.
Melanconium profundum, Penz. & Sacc.
Melanomma leptosphaerioides, Penz. & Sacc.
Neomichelia melaxantha, Penz. & Sacc.
Oxydothis maculosa, Penz. & Sacc.
Phaeodiscula gonospora, Penz. & Sacc.
Rosellinia marginato-clypeata, Penz. & Sacc.
Sporocybe acicularis, Penz. & Sacc.
Sporodermium bogoriense, Penz. & Sacc.
Teichospora xenochaeta, Penz. & Sacc.
Trichopeziza melleo-rufa, Penz. & Sacc.
Trichosphaeria affinis, Penz. & Sacc.
Palm—dead rachises.
Brachysporum obovatum, (Berk.) Sacc.
Karschia tjibodensis, Penz. & Sacc.
Melanomma leptosphaerioides, Penz. & Sacc.
Palm—dead sheaths.
Belonidium glauco-fuligineum, Penz. & Sacc.
Palm—dead spathes.
Chilonectria macrospora, Penz. & Sacc.
Nectria dolichospora, Penz. & Sacc.
Ophionectria trichospora, (B. & Br.) Sacc.
Pandanus—dead leaves.
Anthostomella pandani, (Rab.) Sacc.
Erinella albo-flaveola, Penz. & Sacc.
Lophodermium javanicum, Penz. & Sacc., var. pandani, Penz. & Sacc.
Solenopeziza mellina, Penz. & Sacc.
Pandanus littoralis.
Hyponectria pandani, Rac.
Panicum.
Paikilosporium bogoriense, Rac.
Panicum formosum.
Capnodium stysanophorum, Penz. & Sacc.

Bemoivskia graminis, Rac.
Phyllachora stenospora, (B. & Br.) Sacc.
Pavetta silvatica.
Endophyllum griffithsiae, Rac.
Phaeomacropoda.
Mycogone echinulata, Penz. & Sacc.
Phaius.
Uredo phaji, Rac.
Phalloid fungus—volva.
Sepedonium chrysospermum, (Bull.) Fr.
Phanera.
Meliola curviseta, Rac.
Phaseolus.
Uromyces phaseoli, (Perk.) Lk.
Phyllanthus.
Oidium tabaci, Thuem.
Phyllostachys.
Uredo arundinariae, Sydow.
Phyllostachys—young twigs.
Konradia bambusina, Rac.
Physaria didermoides Roxb.—sporangia.
Hyponectria raciborskii, Penz. & Sacc.
Pierardia dulcis—seeds.
Aspergillus penicillopsis, (Henn. & Nym.) Rac.
Pinanga.
Kordyana pinangae, Rac.
Pistillaria sp.
Penicillium candidum, Link.
Pithecolobium lobatum.
Euryachora pithecolobii, Rac.
Uredo pithecolobii, Rac.
Plectocomia—dead petioles.
Boerlagella velutina, Penz. & Sacc.
Plectocomia—dead rachises.
Anthostoma tjibodense, Penz. & Sacc.
Plectocomia elongata—dead stems.
Winterella eutypoides, Penz. & Sacc.
Podocarpus (?)—dead limbs.
Diatrype parvula, Penz. & Sacc.
Polygonum sp.
Ustilago utriculosa, (Nees) Tul.
Polygonum chinense.
Puccinia solmsii, Henn.
Pongamia glabra.
Stigmatea pongamiae, Rac.
Polypodium longissimum.
Parmularia discoidea, Rac.
Psilotum flaccidum.
Myiocopron millepunctatum, Penz. & Sacc.
Psophocarpus tetragonolobus.
Woroninella psophocarpi, Rac.

Pterocarpus indicus.
Aldona stella-nigra, Rac.
Micronectria pterocarpi, Penz. & Sacc.
Ptychosperma—dead spathes.
Oxydothis nigricans, Penz. & Sacc.
Quercus—acorns.
Xylaria carpophila, Fr.
Quercus—dead leaves.
Dimerosporium hamatum, Penz. & Sacc.
Randia scandens.
Endophyllum griffithsiae, Rac.
Rhododendron javanicum.
Coccomyces rhododendri, Rac.
Cryptomyces rhododendri, Rac.
Exobasidium vulcanicum, Rac.
Rhododendron retusum.
Exobasidium vulcanicum, Rac.
Morenoella gedeana, Rac.
Rottlera floribunda.
Anthostomella rottlerae, Rac.
Rubus moluccanus.
Hamaspora longissima, Körn.
Saccharum officinarum.
Apiospora camptospora, Penz. & Sacc.
Hypocrea saccharina, Rac.
Melanconium sacchari, Massee.
Melanconium saccharinum, Penz. & Sacc.
Stictis arundinacea, Pers.
Trichoderma lignorum, (Tode) Harz.
Salacia—leaves.
Phyllachora amphididyma, Penz. & Sacc.
Scaevola koenigii.
Ramularia scaevolae, Rac.
Schizostachyum blumeanum.
(See Bambusa).
Scirpus—dead leaves.
Lophodermium raapianum, Penz. & Sacc.
Scleroderma—peridium.
Hypocrea sclerodermatis, Penz. & Sacc.
Shorea dyeri—leaves.
Meneda purpurea, Rac.
Smilax sp.
Puccinia prainiana, Barel.
Sorghum—culm.
Stictis arundinacea,
Spatholobus littoralis.
Neottispora longiseta, Rac.
Spermacoce.
Puccinia brevispora, Rac.
Spondias acida, borbonica, and *dulcis.*
Dietelia eviae, Rac.

Sponia virgata.
Asternia sponiae, Rac.
Dimerosporium occultum, Rac.
Stems—dead.
Boerlagella laxa, Penz. & Sacc.
Chromosporium pallens, Penz. & Sacc.
Byssonectria delicatula, Penz. & Sacc.
Epicoccum angulosum, Penz. & Sacc.
Helminthosporium bogoriense, Penz. & Sacc.
Nectria arundinella, Penz. & Sacc.
Nectria leucotricha, Penz. & Sacc.
Oxydothis grisea, Penz. & Sacc.
Stilbum perexiguum, Penz. & Sacc.
Torula heteromorpha, Penz. & Sacc.
Vermicularia dematium, (Pers.) Fr.
Xenopus farinosus, Penz. & Sacc.
Zythia abnormis, Penz. & Sacc.
Stephania capitata.
Trabutia stephaniae, Rac.
Sterculia subpeltata.
Lambro insignis, Rac.
Strophanthus dichotomus.
Hemileiopsis strophanthi, Rac.
Symplocos fasciculata.
Exobasidium symploci-fasciculatae, Rac.
Physalospora symploci, Rac.
Talauma mutabilis.
Clypeolum talaumae, Rac.
Tectona grandis.
Uredo tectonae, Rac.
Termites—nests.
Xylaria torrubioides, Penz. et Sacc.
Termites—nymphs.
Cordyceps koningsbergeri, Penz. et Sacc.
Terminalia catappa.
Ramularia catappae, Rac.
Tetracera.
Marssonia tetracerae, Rac.
Tetranthera.
Phyllachora laurinearum, Rac.
Tetranthera amara.
Aecidium litsaeae, Pat.
Thelymitra javanica.
Aecidium thelymitrae, Rac.
Thespesia populnea.
Physalospora hibisci, Rac.
Tinospora cordifolia and *crispa.*
Elsinoe menispermacearum, Rac.
Torenia asiatica.
Puccinia toreniae, Rac.
Tradescantia capitata.
Kordyana tradescantiae, (Pat.) Rac.

Trichia verrucosa—peridium.
Ophionectria trichiae, Penz. & Sacc.
Trunks—dead.
Aspergillus candidus, Liuk.
Corallomyces brachysporus, Penz. & Sacc.
Coryne javanica, Penz. & Sacc.
Didymobotryum obesum, Penz. & Sacc.
Mollisia viridulo-mellea, Penz. & Sacc.
Penzigia macrospora, Penz. & Sacc.
Podosporium casuarina, Penz. & Sacc.
Xylaria gigantea, Zipp.
Xylaria holodapha, Bk. var. camptospora, Penz. & Sacc.
Xylaria hyperythia, Mont.
Xylaria involuta, Kl.
Xylaria kegeliana, Lév.
Xylaria leucosticta, Penz. et Sacc.
Xylaria nigripes, Kl.
Xylaria polysticta, Penz. et Sacc.
Xylaria scopiformis, Mont.
Xylaria subterranea, (Schw.) Sacc.
Xylaria varians, Penz. & Sacc.
Xylaria xanthophaea, Penz. & Sacc.
Uredo spp.
Tuberculina persicinae, Detm.
Vaccinium teysmannianum.
Ahnella tristis, Rac.
Strumella annularis, Rac.
Vespa velutina.
Cordyceps oxycephala, Penz. & Sacc.
Vitis serrulata.
Elsinoe viticola, Rac.
Wood—rotting.
Acanthostigna scleranthoides, Penz. & Sacc.
Acrostalagmus cinnabarinus, Corda.
Amallospora dacrydion, Penz.
Amphisphaeria atro-grana, (C. & B.) Sacc.
Amphisphaeria callicarpa, Penz. & Sacc.
Arthropodium chrysocephalum, Penz. & Sacc.
Belonidium albo-cereum, Penz. & Sacc.
Bertea moriformis, (Tode) de Not.
Boerlagella velutina, Penz. & Sacc.
Calonectria aurantiella, Penz. & Sacc.
Chaetosphaeria pusilla, Penz. & Sacc.
Cudoniella javanica, Henn. subsp. microspora, Penz. & Sacc.
Excipula oospora, Penz. & Sacc.
Graphium leucophaeum, Penz. & Sacc.
Helminthosporium bogoriense, Penz. & Sacc.
Helminthosporium gigasporum, B. & Br. subsp. javanicum, Penz. & Sacc.
Helotium javanicum, Penz. & Sacc.
Helotium subserotinum, Henn. & Nym.
Hormosperma pusillum, Penz. & Sacc.

Hypocrea lenta, (Tode) Berk.
Hypoxylon bifrons, de Not.
Hypoxylon microstroma, Penz. & Sacc.
Leptosporella gregaria, Penz. & Sacc.
Leptosporella sparsa, Penz. & Sacc.
Letendraea atrata, Penz. & Sacc.
Listeromyces insignis, Penz. & Sacc.
Mollisia cinerea, (Batsch) Karst.
Myriococcum (?) spinuligerum, Penz. & Sacc.
Ophioceras hystrix, Sacc. subsp. tjibodensis, Penz. & Sacc.
Ophiochaeta raciborskii, Penz. & Sacc.
Ophionectria conica, Penz. & Sacc.
Orbilia macrospora, Penz. & Sacc.
Orbilia sinuosa, Penz. & Sacc.
Podobelonium citrino-album, Penz. & Sacc.
Pseudohelotium microcenangium, Penz. & Sacc.
Rosellinia mammiformis, (Pers.) Ces. & de Not.
Sordaria caudata, (Curr.) Sacc.
Sorokina insignis, Penz. & Sacc.
Spegazzinia ornata, Sacc.
Sporodesmium tenellum, Penz. & Sacc.
Stilbum macrosporum, Penz. & Sacc.
Trichosperma griseo-candidum, Penz. et Sacc.
Xylaria axifera, Mont.
Xylaria cupressiformis, (Mich.) Becc.
Xylaria diceras, Lév.
Zignoella eumorpha, Penz. & Sacc.

Wrightia javanica, mollissima and *tinctoria.*
Hemileiopsis wrightiae, Rac.

Xanthorrhoea—rotting wood.
Trichopeziza citrino-alba, Penz. & Sacc.

Zalacca—dead leaves.
Oncospora pezizella, Penz. & Sacc.

Zalacca—dead petioles.
Pezizella isabellino-rufa, Penz. & Sacc.

Zalacca—dead rachises.
Pirottaea versicolor, Penz. & Sacc.

Zea mais.
Peronospora maydis, Rac.

Zingiberaceae—dead stems.
Aleurina substipitata, Henn. var. pleuropoda, Penz. & Sacc.

C. F. Baker.

RAINFALL at the Director's house, Botanic Gardens, Singapore, during the first half of the year, 1917, in inches.
Readings taken always at 8 a.m. and credited to the date in which twenty-four hours begin.

Date.	Jan.	Feb.	March.	April.	May.	June.
1	.01	.01	.14	..	.01	.66
2	..	.11	.59	.02	..	.45
3	.05	..	.01	.12	..	.12
4	.65	trace	..	.55	trace	.05
5	.01	.09	2.79	..	..	2.87
6	.23	.53	2.66	.17	.15	.05
7	..	.21	.79	..	1.54	..
8	1.06	.20	.09	trace	.11	.28
9	3.22	.29	.02	..	.01	.01
10	2.72	.06	.02	.03	.01	..
11	.84	1.96	.92	2.32	.01	.62
12	.06	.37	.08	.51	..	.01
13	2.17	.45	.41	.27	..	..
14	.25	.14	.22	trace	.01	..
15	.55	..	.39	.04	.21	..
16	.08	2.68	.59	..	..	..
17	.16	.48	.57	..	..	..
18	.51	.42	.01	.02	.03	..
19	.01	.02	.15	.14	.05	.03
20	..	..	.06	.04	.01	..
21	.38	1.72	.04	..	.47	.10
22	..	1.61	..	.40	.06	..
23	..	.07	.02	..	..	..
24	.50	.12	.13	..	2.42	.18
25	trace	.58	.85	..	.05	..
26	.25	.01	.01	..	..	.01
27	.10	.05	.04	.02	.29	.01
28	.36	.65	trace	..	.04	.43
29	.41		..	.48	.03	.70
30	.04		.13	.35	..	..
31	.91		.05		..	
	15.43	12.83	11.78	5.48	5.51	6.58

RAINFALL at the Director's house, Botanic Gardens, Singapore, during the second half of the year, 1917, in inches.

Readings taken always at 8 a.m. and credited to the date in which twenty-four hours begin.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	82	.43	trace	..	1.85	1.64
2	.01	2.63	..	.28	.02	.08
3	..	..	.52	..	..	.27
4	.04	.10	..	..	..	.15
5	.05	.39	..	..	..	.02
6	..	.35	..	..	..	.82
7	..	.38	.95	1.56	.17	.01
8	.35	.12	.37	.51	..	.02
9	.04	.21	..	..	.60	.22
10	..	2.69	..	trace	.02	1.61
11	.08	.01	.08	..	.30	.63
12	.04	trace	.67	.23	.01	.28
13	.07	.51	1.29	.37	..	..
14	.35	1.41	trace	.89	.04	.18
15	.03	.06	trace	1.00	..	.02
16	..	..	1.34	.43	.58	.40
17	.02	.06	trace	.32	.01	.18
18	..	..	2.61	.19	.16	.22
19	..	..	.01	.27	.03	.27
20	..	..	.01	1.75	trace	.32
21	..	trace	trace	.67	..	.05
22	..	1.97	.02	.07	.36	.26
23	.11	1.37	.03	..	.03	.07
24	..	.14	.68	..	.04	..
25	.25	.83	1.63	.25	.02	.02
26	.11	.02	.36	..	..	trace
27	..	.02	..	..	.06	..
28	.03	trace	trace	..	.07	.54
29	..	1.02	.07	.01	.63	.03
30	..	.01	.03	.38	.01	.69
31	..	..		.02		.05
	2.40	14.73	10.67	9.70	5.01	9.05

RAINFALL at the head of the Waterfall Gardens, Penang, during the first half of the year, 1917, in inches.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Data kindly supplied by the Municipal Commissioners of Georgetown, Penang.

Date.	Jan.	Feb.	March.	April.	May.	June.
1	..	.04	.38	..	..	..
2	..	.02	.13	..	..	.21
3	..	..	..	..	.20	..
4	..	..	.47	..	..	..
5	.60	..	.12	.41	.08	..
6	.83	..	3.25	.36	.14	.07
7	.30	.44	.60	..	.20	2.20
8	..	.04	.03	..	1.23	.30
9	..	..	.21	..	.13	..
10	..	..	..	.17	.09	.15
11	..	..	..	.61	.55	1.33
12	..	..	.26	1.05	.04	.06
13	..	..	1.17	..	.10	..
14	.15	..	..	..	..	..
15	.10	..	..	.12	.13	..
16	1.02	.19	1.59	1.27	.05	..
17	..	.10	.60	..	..	..
18	..	.46	..	.76	..	..
19	..	..	..	.26	.54	..
20	..	..	..	..	1.90	..
21	..	..	..	.36	.30	..
22	..	.67	.13	.08	..	.40
23	.06	.36	1.62	1.56	..	..
24	..	.13	..	.27	..	.68
25	2.06	.07	..	..	.82	.24
26	.06	.08	..	..	..	..
27	..	.49	..	1.03	..	..
28	.46	.20	..	..	.31	..
29	..		..	.16	.20	2.08
30	..		..	..	..	.11
31	..		..		..	
	5.64	3.29	10.56	8.47	7.01	7.83

RAINFALL at the head of the Waterfall Gardens, Penang, during the second half of the year, 1917, in inches.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Data kindly supplied by the Municipal Commissioners of Georgetown, Penang.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	..	..	..	..	.08	..
2	..	.77	.90	..	1.22	1.88
3	.17	.19	1.23	1.32	..	..
4	1.21	.60	.49	..	..	.58
5	.80	.96	..	..	1.43	..
6	3.77	2.43	..	..	.33	..
7	1.57	..	1.22	.18	6.60	.57
8	.57	.24	.36	.03	.23	.10
9	.23	..	..	..	.73	..
10	..	.25	.20	.07	.03	..
11	..	..	..	1.36	..	..
12	.06	..	..	3.04	..	..
13	.04	..	..	.74	.80	.78
14	.83	.70	..	1.49	..	..
15	..	.55	.49	..	..	..
16	..	.54	.68	.25	..	.03
17	.65	..	.98	.65	.12	.13
18	.11	..	.99	.35	.15	.18
19	..	..	.48	.31	.14	..
20	.16	..	1.03	.97	..	.72
21	..	1.73	.06	.14	.17	.18
22	..	..	..	.79	..	.03
23	.13	.96	.59	..	..	.20
24	..	.10	2.49	..	.63	..
25	..	3.75	.85	..	.47	.64
26	.07	1.73	.39	..	..	..
27	..	.09	.04	..	..	..
28	..	..	.21	.18	..	.02
29	..	..	..	..	1.30	..
30	..	.33	..	..	.55	..
31	.42	..		..		..
	10.79	15.92	13.68	11.87	14.98	6.04

SUMMARY OF RAINFALL.

	SINGAPORE.			PENANG.		
	No of rainy days.	Amount of rain in inches.	Longest Spell without rain.	No. of rainy days.	Amount of rain in inches.	Longgest Spell without rain.
January - -	26	15.43	2	10	5.64	8 (partly in Dec. 1916.
February -	25	12.83	1	14	3.29	7
March - -	28	11.78	1	14	10 56	
April - -	18	5.48	4	15	8.47	12
May - -	20	5.51	2	18	7.01	3
June - -	17	6.58	6	12	7.83	9
July - -	16	2.40	3	16	10.79	4
August - -	25	14.73	3	17	15.92	4
September -	23	10.67	3	19	13.68	4
October - -	19	9.70	4	16	11.87	15
November -	21	5.01	4	17	14.98	3
December -	28	9.05	1	14	6.04	4
Total	266	109.18	—	182	116.08	—

	Singapore	Penang
Greatest amount in 24 hours ...	3.22	6.60
,, ,, 48 ,, ...	5.94	6.93
,, ,, 72 ,, ...	7.00	8 36
Excessively rainy periods, more than 5.00 having fallen in 72 hours (January and March.) - - -	2	4 (July, Aug., Oct. and Nov.)
No. of days when the condition persisted	4	10
Periods of comparative drought less, than 0 02 having fallen in 120 hours - -	2	8
No. of days when the condition existed (3 in June, 1 in July.)	4	26 (4 and 2 and 2 in Jan., 3 in Feb., 8 in Feb.-Mch., 5 in June, 1 in Sept., and 1 in Oct.).

Missing No 3

PLATE I.

Dioscorea alata. Race No. 192 on the left, race No. 22 on the right.

Dioscorea alata. Race No 70.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. II. Issued Augnst 12th 1918 No. 2

A REPORT UPON THE EXPERIMENTAL CULTIVATION OF THE GREATER YAM—DIOSCOREA ALATA—IN 1917.

This is the third of a series of reports upon the cultivation of the Greater Yam in the Gardens, Singapore. The first was printed in this *Bulletin,* vol. I., No. 9, pp. 297-304, and in it outline camera lucida drawings of sixteen races were given. The second report was printed in Vol. I., double No. 11-12, pp. 371-396, with illustrations from photographs of fifteen races upon six plates. In this report fourteen races are illustrated upon four plates, No. 76 appearing upon two of them. Besides these three reports, there is another in the *Philippine Agriculturist and Forester,* Vol. III., 1915, pp. 205-209, with illustrations of seven races. When the first report in the *Gardens' Bulletin* and that in the *Philippine Agriculturist and Forester* were published, the numbering system of the Gardens had not been made consistent, and was not referred to: therefore it is now convenient to draw into one list the races already illustrated,—being in all thirty-eight. This list is printed as an appendix on pp. 42-44.

The plates with this report show successively various morphological features not brought out before. All the figures are on the same scale, which is indicated by a half-metre measure in each block. The upper block of the first plate shows what variation may be found in sister plants; it represents five tubers of an African race called on the Gold Coast Eururuka nkakyi, and in Singapore grown under the number 192, together with four tubers of a race from Manila grown under the number 22. The African race produced tubers varying greatly in relative length, and in branching and in being sometimes flattened and sometimes round in transverse section: the Manila race varied in its tubers being sometimes flattened and sometimes round. It is necessary to ascertain the "why" of this, if the classification is to be perfected; and attention is directed to it accordingly. The lower block of plate i, exhibits four tubers of a race from Manila grown under number 76,

of which two more tubers are shown on plate ii, at the top on the right. These tubers were usually deeply fingered, which is not such as the race had produced in 1916 (vide Plate ii, of the Bulletin, Vol. I, double No. 11-12). It may be that twinning and grouping of tubers is the result of an arrest of the first attempt at tuber-formation in such a case; but this is a guess only to be investigated by experimentally varying the conditions in planting. The upper block of plate ii. illustrates approximately the condition which Sir David Prain and the writer named "farciniformis" or sausage shaped,—a condition common in the Gangetic valley and in other parts of India, which has not been figured in the previously printed plates. It is seen that when the race No. 76, is at one of its extremes, namely that on the right of the Plate ii, it is such as can reasonably be classed as farciniformis but at another extreme it is far away. This observation is a caution against accepting ill-developed tubers as proving their race to belong to "farciniformis."

Race 76 has other characters than those of shape which must be remarked: its flesh is peculiarly firm and of the yellow of old ivory. Cooked it was pronounced fair. It is a heavy yielder, with a prickly stem.

Continuing the comments on the plates, and turning to the middle block of plate ii, four tubers of race 132,—the Fijian "Uvi kaboa"—are seen, above four tubers of the race No. 44, which was received from the Bureau of Agriculture, Philippine islands. These illustrations will serve as references, so that it may be possible in descriptions to point to them saying, "fingered to the degree of No. 132," or "fingered to the degree of No. 44."

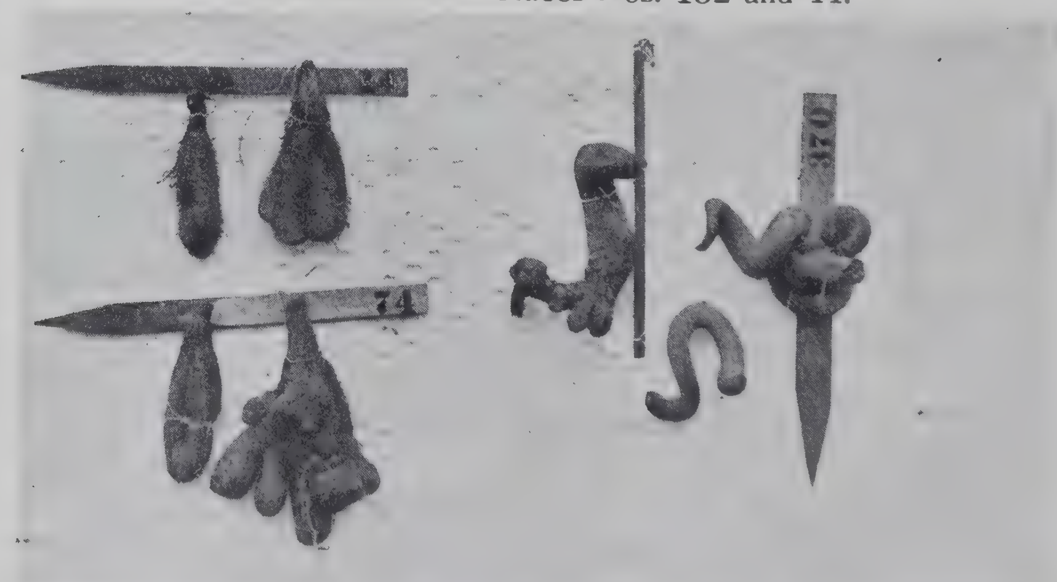
The bottom block of plate ii, has a historical bearing, for it exhibits what Rumphius called *Ubi tangan* or Hand yam, and *Ubi ular* or Snake yam, the first on the left in races 14 and 74, and the second on the right in race 370. All three came from the Philippine islands. To be really like a hand, the tubers must be well grown; fasciation wherefrom the flatness comes not developing unless the tuber is strong enough to branch freely. Therefore the tubers on the extreme left which are not well developed, do not show it. Rumphius hitherto has been much misunderstood in regard to Ubi ular: Roxburgh though it must be a wild yam other than *Dioscorea alata,* and called a most unlike Indian species "Dioscorea anguina" in consequence (Flora indica, 1832, iii, p. 803).

It is quite certain that Ubi ular is *Dioscorea alata,* and as that tuber shows which in the plate is in contact with the half-metre measure, it should be classed along with those races which do not bury their tubers by descending into the earth, but may extrude them,—those which have to be cultivated by earthing-up.

Plates iii, and iv, are both given to illustrate this peculiar group,—the not-burying or apogeotropic group. Plate iv, illustrates it at its extreme; plate iii, shows races which are intermediate between the more usual state and it. Firstly on the upper

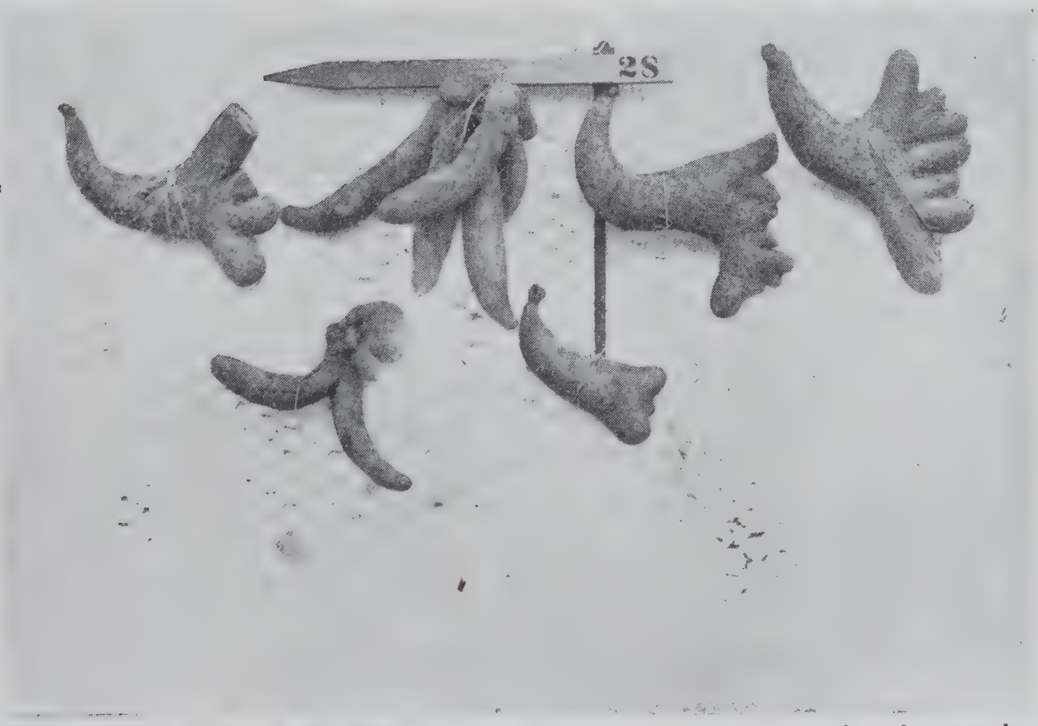
Dioscorea alata. Races Nos. 140 and 76,

Dioscorea alata. Races Nos. 132 and 44.



Dioscorea alata. The flattened tubers of Nos. 14 and 74, and the snake - like tubers of No. 370.

Dioscorea alata. Race No. 174 showing how its fingers tend to be horizontal, and race No. 78 showing fingers which descend.



Dioscorea alata - Race No 28, a curving flattened and somewhat fingered yam.

block of plate iii, are shown tubers of race 174, Khoai tiem from Saigon, in which the fingers diverge, and race 78, a yam from Manila, in which they do not. They are shown together for contrast, as it is easy to conceive transitions whereby the interval between race 174, and races 38 and 72, might be bridged through race 28. In race 28, which was received from the College of Agriculture, Los Banos, Philippine islands, as Tumuktok, the tuber exhibits a tendency to divide into two which curve away from each other, and in the angle between them a series of smaller branches may appear. On plate iv, lower block, one of the tubers photographed shows down its side just such a series of smaller branches as form in race 28.

Race 28 behaved slightly differently in 1916 (vide plate v of the Bulletin Vol. I, double No. 11-12); and that this was so, is interesting, for it suggests how considerable an influence the conditions may have upon the form,—influences at present only to be recognised as operative but to be analysed by further work. It is well known that monstrosities of all kinds in plants appear fixable by selection, but the tendency to exhibit them is suppressed if the plant is weakly or not under the best of conditions. So would it be with regard to these yams; and therefore if their characters are to be brought out, they must be richly cultivated.

This brings us to the conditions of the 1917 crop. An attempt was made in 1917 to get more into the available ground by closer planting than in 1916. Most of the sets were planted 2 feet by 3 feet (only the up growing yams 2 feet by 9 feet) whereas in 1916 they had been 2 feet by 5 feet. This closer planting while agriculturally correct because the yield was hereby increased, was not sound from the botanical standpoint, as the plants competed with each other too much to develop quite freely and fully, the returns from each race at the same time varying inconsistently from those got in 1916. The following are tables comparing the two years.

YAMS, NOT REQUIRING EARTHING UP.

	Year 1916.	Year 1917.
No. of hills	582	520
Area	11330 sq. feet	3120 sq. feet
being of an acre	.260	.072
or of a hectaire.. ..	.105	.025
Sets which failed	23	84
which grew	559	424
Return	1810076 grammes 3989 lbs.	961117 grammes 2118 lbs.
Yield per hectaire ..	17238.82 kilos	38444.68 kilos
per acre	6.89 tons	13.16 tons
Average yield per hill ..	3110 grammes	1849 grammes
i.e. failures included ..	6.85 lbs.	4.07 lbs.
Average yield per plant ..	3238 grammes	2267 grammes
which grew	7.14 lbs.	4.99 lbs.

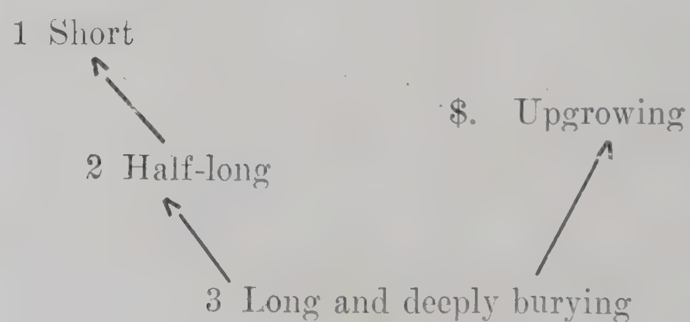
Yams requiring Earthing up.

	Year 1916.	Year 1917.
No. of hills	61	51
Area	1188 sq. feet	918 sq. feet
being of a hectaire ..	.011	.0085
being of an acre	.027	.021
Sets which failed	0	3
Sets which grew	61	48
Return	189259 grammes 417 lbs.	153207 grammes 338 lbs.
Yield per hectaire ..	17205.36 kilos	18021.18 kilos
Yield per acre	6.89 tons	7.18 tons
Average per hill .. .. i.e. failures included ..	3103 grammes 6.84lbs.	3004 grammes 6.63 lbs.
Average per plant .. which grew	3103 grammes 6.84 lbs.	3192 grammes 7.04 lbs.

It is distinctly of interest that these upgrowing yams which in 1917 had wide intervals of nine feet between the rows in which they stood (for the convenience of earthing them up) should have returned scarcely more with these nine feet intervals than they did in the year 1916 when the intervals were five feet; for it indicates that the interval of five feet is quite adequate to prevent competition between the rows under the conditions of soil and climate that they were subjected to.

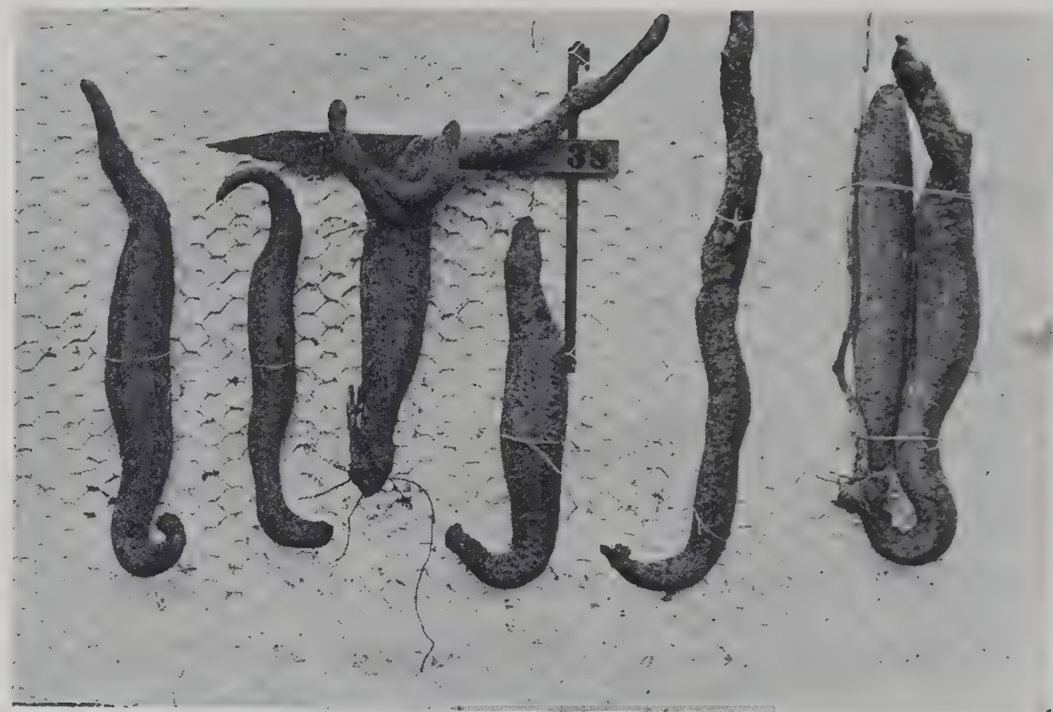
The return of the other yams was, as stated already, reduced when in the year 1917 the rows were approximated.

The year 1917 was a very wet one, and the water table so rose in the soil as to make the conditions very wet at the lower end of the piece of land used. At this lower end were the deeper going yams. The yams were in fact planted in accordance with the scheme which was proposed as a basis for classification in this Bulletin, vol. I, p. 377 in the following diagram.

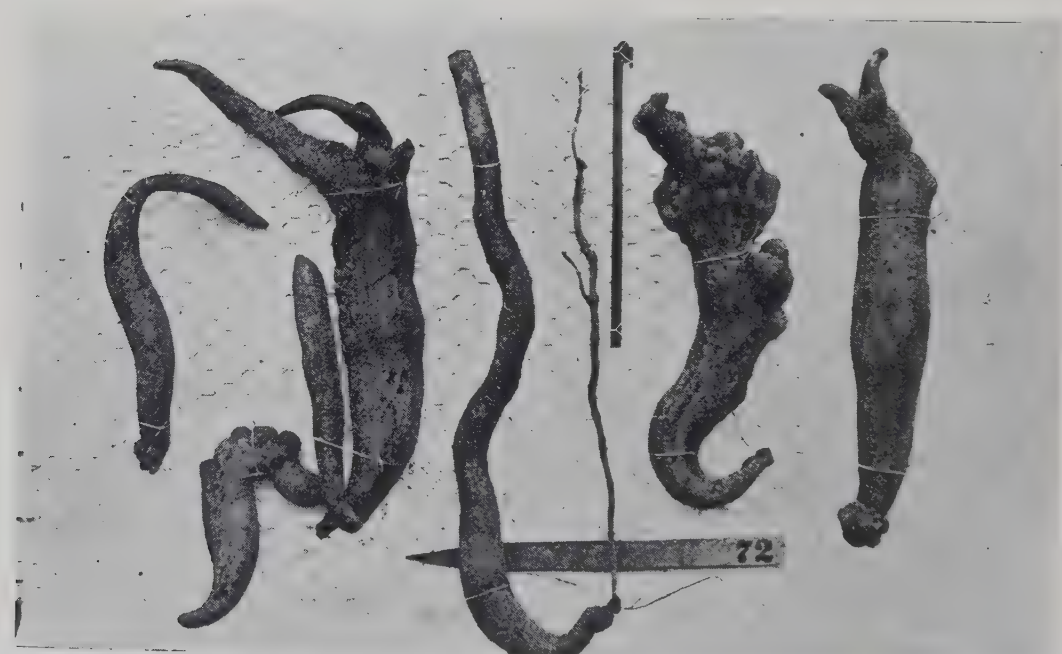


those to the left occupied one bed with the longer at the lower end, and the upgrowing occupied another bed. The first bed had a gentle slope, so that the deeper going were the more likely to be water-logged.

PLATE IV.



Dioscorea alata. Race No. 38.



Dioscorea alata. Race No. 72.

The following table suggests, but does not prove that they were placed at a disadvantage.

	In 1916.	In 1917.
Races with the longest tubers	236 tubers with average weight 3336.99 gr.	125 with average weight 1795.64
Races with shorter tubers	114 do. 4575.17	78 do. 2750.54
Short tubers	106 do. 3543.75	94 do. 2401.95

being a reduction upon the longest of .. .. 46 per cent.
the shorter .. .. 40 „
the short .. .. 32 „

The figures also suggest that it is not the longest and deepest going which give the largest returns; but that those which are half-long, or perhaps one might say between half-long and long, are the most prolific.

The return per area, but not the relative return was interfered with by thieves who robbed at night but not discriminatingly, taking from the back of the bed where they thought their operations most hidden.

In this Bulletin, Vol. I, p. 306 the advantage to the new plant of using the top of the old tuber for a set was stated, and on p. 307, it was shown by how much these tops give an early start to the new shoot. In 1917 top halves were planted against bottom halves in no less than 56 races, 154 tops against 136 bottoms. In 42 races the average weight of the tubers produced by the tops was greater than the average weight of tuber produced from the bottoms, and in 13 cases it was the reverse.

Most of the races grown have now been tried cooked at least once; but so long as the Gardens are without the use of a laboratory, accurate comparisons are most difficult to make. The opinion has been formed that all the upgrowing yams are excellent for the table when properly cooked. The others vary a little among themselves. Further examinations will be made, especially with a view to desisting from cultivating that which is inferior.

Hitherto the study of the morphology of the tubers has demanded the cultivation of them all.

The classification resulting may be expressed by the following table wherein the numbers given denote the races which have been figured.

Elongation and branching of the tuber.		Combined with flattening of the tubers.	Combined with multiplication of tubers arising from stem-tissue.	Combined with tendency of a stem tissue to produce additional uprising fleshy autumn shoots.
Class I. Short.				
a. unbranched	26, 70		26	
b. lobulate	24	50, 58, 88. 192		
c. fingered	78, 170, 74	20, 44, 98	22	
Class 2. Half long.				
a. unbranched	8, 132, 192		8,	2, 6, 8, 18, 140
b. with lobe-like branches	10	14, 74		
c. with finger-like ... ... branches	76			
Class 3. Long.				
31 tubers set into stem tissue				
a. unbranched	12, 68, 118, 156		12, 30	16
b. with lobe-like branches				
c. with finger-like branches				
32 tubers attached by a neck to stem-tissue.				
a. unbranched	162			
b. with lobe-like branches...	186			
c. with finger-like branches				
4 Not burying.				
a. unbranched	32. 72			
b. with lobe-like branches ...			34, 38	
c. with finger-like branches		28, 36, 370		

A list of the races already figured: the number after the name is that under which they were received.

No. 2, native name unknown, origin a deserted garden on Bukit Timah, Singapore island, Gard. Bull. I, Nos. 11-12, pl. iii.

No. 6. "Ubi merah," origin Singapore market. Gard. Bull. 1, Nos. 11-12, pl. iii.

No. 8. "Ubi, red fingered," origin Luzon, Gard. Bull. 1, No. 9, fig. 1 on p. 299.

No. 10. "Tugui, finger shaped, No. 1057," origin Luzon, Gard. Bull. 1, No. 9, fig. 2 on p. 299.

No. 12. "Ubi, finger shaped, No. 1056," origin Luzon, Gard. Bull. 1, No. 9, fig. 4 on p. 299.

No. 14. "Paquit, No. 3790," origin Luzon, Gard. Bull. 1, No. 9, fig. 8 on p. 299; and II, No. 2, plate ii.

No. 16. Origin Luzon, Gard. Bull. 1, No. 9, fig. 6 on p. 299; and Philip. Agric., 111, fig. 14 on p. 207,

No. 18. "Ubi, red No. 1042," origin Luzon, Gard. Bull. 1, No. 9, fig. 5 on p. 299.

No. 20. "Ubi, red, No. 1031," origin Luzon, Gard. Bull. 1, No. 9, fig. 10 on p. 299; and Philip. Agric. III, fig. 16 on p. 207.

No. 22. "Ubi, white, No. 1019," origin Luzon, Gard. Bull. 1, No. 9, fig. 8 on p. 299; and II, No. 2, plate i.

No. 24. "No. 931," origin Luzon, Gard. Bull. 1, No. 9, fig. 7 on p. 299.

No. 26. "Ubi, white, No. 1055," origin Luzon, Gard. Bull., vol. I, No. 9, fig. 9 on p. 299.

No. 28. "Tumuktok, No. 1095" from the College of Agriculture P. I. Gard. Bull., vol I, No. 9, fig. 1 on p. 301 and Nos. 11-12, plate v; and vol. II, plate iii.

No. 30. "Ubag, No. 960" from the College of Agriculture, P. I. Gard. Bull., vol. I, No. 9, fig. 2 on p. 301.

No. 32. "Tinuque, No. 956," from College of Agriculture, P. I. Gard. Bull., vol. I, No. 9, fig. 3 on p. 301; and Philip Agricult., vol. III, fig. 18 on p. 207.

No. 34. "Ballolong, No. 943," from the College of Agriculture, P. I., Gard. Bull., vol. I, No. 9, fig. 4 on p. 301.

No. 36. "No. 935," origin Manila., Gard. Bull., vol. I, No. 9, fig. 5 on p. 301.

No. 38. "Tamis, Ubi, white, No. 945," from Bureau of Agric. Manila, Gard. Bull., vol. I, No. 9, fig. 6 on p. 301: and Nos. 11-12, plates v and vi, and vol. II, plate iv.

No. 44. "Ubi, red, No. 1025," from the Bureau of Agriculture, Manila, Gard. Bull., vol. II, No. 2, plate ii.

No. 50. "No. 824," from the Bureau of Agriculture, Manila, Philip. Agricult., vol. III, fig. 17 on p. 207.

No. 58. "Binaksan, Ubi, No. 329," from the College of Agriculture, Philippine Islands, Philip. Agricult., vol. III, fig. 15 on p. 207.

No. 68. "No. 1692," from Bureau of Agriculture, Manila., Philip. Agricult., vol. III, fig. 12 on p. 207: Gard. Bull., vol. I, Nos. 11-12, plate ii.

No. 70. "Caroline Islands yam, No. 3793," from the Bureau of Agriculture, P. I. Gard. Bull., vol. I, Nos. 11-12, plate ii.

No. 72. "Sinawang pulo yam, No. 955," from College of Agriculture P. I. Gard. Bull., vol. I, Nos. 11-12, plate vi. and vol. II, No. 2, plate iv.

No. 74. "Ubi from Aringay in La Union Province, No. 937," from the Bureau of Agriculture, Manila, Gard. Bull., vol. II, No. 2, plate ii.

No. 76. "Sinanto, No. 958," from the College of Agriculture, P. I. Gard. Bull., vol. I, Nos. 11-,12 plate ii; and vol. II, No. 2, plates i and ii.

No. 78. "Ubi, No. 938," from the College of Agriculture, P. I., Gard. Bull., vol. II, No. 2, plate iii.

No. 88. "Ubi, red, No. 1041," from the Bureau of Agriculture, P. I., Gard. Bull., vol. I, Nos. 11-12, plate iv.

No. 98. "Khoai Siam," from the Botanic Garden, Saigon. Gard. Bull., vol. I, Nos. 11-12, plate iv.

No. 118. "Fijian yam, No. 20710," from Royal Botanic Gardens, Calcutta, Gard. Bull., vol. I, Nos. 11-12, plate i.

No. 132. "Fijian yam, Uvi kaboa, No. 20679," from Royal Botanic Gardens, Calcutta, Gard. Bull., vol. II, No. 2, plate ii.

No. 140. "No. 35560," from the Royal Botanic Gardens, Calcutta, Gard. Bull., vol. II, No. 2, plate ii.

No. 156. "Fijian yam, No. 20702," from Royal Botanic Gardens, Calcutta, Gard. Bull., vol. I, Nos. 11-12, plate i.

No. 162. "Phan shriew, from the Khasia hills, No. 35606," from the Royal Botanic Gardens, Calcutta, Gard. Bull., vol. I, Nos. 11-12, plate i.

No. 170. From Port Darwin, Australia, Gard. Bull., vol. I, Nos. 11-12, plate iv.

No. 174. "Khoai tiem," from the Botanic Gardens, Saigon, Gard. Bull., vol. II, No. 2, plate iii.

No. 186. "No. 35575, from Lumding, Assam," from the Royal Botanic Gardens, Calcutta, Gard. Bull., vol. I, Nos. 11-12, plate i.

No. 192. "Eururuka nkakyi, No. 17," from the Gold Coast, Department of Agriculture, Gard. Bull., vol. II, No. 2, plate i.

No. 370. Origin uncertain, but almost certainly Luzon, Gard. Bull., vol. II, No. 2, plate ii.

ORCHID NOTES.

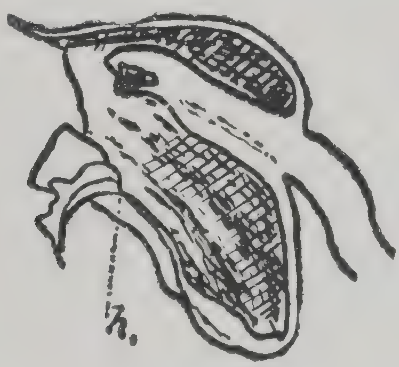
Acanthephippium javanicum, Blume.

The discovery of this orchid on Gunong Tampin, Negri Sembilan, not only adds a large-flowered species to the list of those known to occur in the Malay Peninsula but adds a genus; for no species of *Acanthephippium* have been found within our borders previously. It occurs on the mountain at about 1800 feet above sea-level in forest about the sides of a stream in a little sandy hollow of unusual conformation. From this spot it has been introduced into the Botanic Gardens, Singapore; where it grows freely.

Flower of *Acanthephippium javanicum*, slightly reduced, viewed horizontally from the side, and from in front.

The plant was first described by Blume who had found it on Gunong Salak in Java. He afterwards published a coloured plate in his *Flora Javae,* Orchidaceae, t. 49 (1858), but before this figure appeared, the orchid was already in English glass-houses, and Lindley in the *Botanical Register,* 1846, t. 47, as well as Sir William Hooker in the *Botanical Magazine,* 1850, t. 4492, had issued plates. The general colouring of the Tampin plant is nearly as in Lindley's and Blume's figures, *i.e.* a dull claret merging to yellowish white, with considerable mottling and streaking, all the colours dull except on the lip which is brightly coloured from claret at the edge of the side-lobes to a clear chrome yellow on the mid-lobe which ends in a deep claret tip. This lip is just like a saddle upside down, but with low spines as the figure shows where a saddle should be at its smoothest; Blume's name for the genus refers to the saddle-like appearance and to these low spines.

The flower is 5.5 cm. from the tip of the dorsal sepal to the bottom of the bucket, and 2.5 cm. across the mouth from tip to tip of the slightly recurved lateral petals; the opening into the bucket, disregarding the degree to which the lip blocks it, is 1.7



Flower of *Acanthephippium javanicum* in section ; h—the hinge of the lip.

cm. across. The lip is finely hinged (h. in the figure) obviously with the object of upsetting the balance of a visiting insect and throwing it against the sexual organs. By the slight projection of the lip from the mouth of the flower and by its conspicuous colouring it is the part offered to an insect for alighting. The drawing shows the saddle fallen forward as far as possible. The side-lobes of the lip which make the flaps of the saddle curve a little and would keep a visiting insect in the middle line and therefore just under the column with its sexual organs.

The interior of the bucket is more spotted than the exterior and deeper in colour. No free honey has been found, and no scent detected.

The flowering season is May, June and July. Up to four flowers have been seen open on the same raceme.

Blume's original locality, Gunong Salak, has been named. Lindley studied the plant in the nurseries of Messrs. Loddiges, and from his account the reader is led to suppose that Loddiges' plant

came from the same place, where Dr. J. J. Smith also has obtained it in recent years. Whence came the much more brightly coloured plant that flowered at Kew and furnished Sir William Hooker with his drawing, is unrecorded.

Dr. J. J. Smith records *Acanthephippium javanicum* as occuring on Gunong Salak, at Tjigombong and Bandongan, and on the island of Telo and in New Guinea (*Orchideen von Java,* 1905, p. 215).

Stauropsis breviscapa, Rolfe.

In 1912 Mr. J. W. Anderson, then Assistant Curator of the Botanic Gardens, collected plants of this orchid in Sarawak and brought them alive to Singapore. They flowered very freely in April, 1916.

The plant rises to 3 feet, and bears many inflorescences of 2—6 flowers. The flowers are mustard yellow with rich umber brown markings. They face horizontally. The lip is very lightly hinged and hangs by its own weight: it is thick along the middle line, by reason of a ridge rising near the base, and continuing into a white point. It has brown lines on it, short and parallel, running towards the side lobes which are a little concave. The edges of the sepals and petals are crisped as in so many Vandas.

The following two sheets in the Singapore Herbarium are considered as of the same species:—

Sarawak without locality, *Sahib,* flowered in the Singapore Gardens, 23.4.14.

Bidi, Sarawak, *Mrs. Brooks,* Sept. 28, with the note. " This is a limestone orchid and occurs also at Kuop.

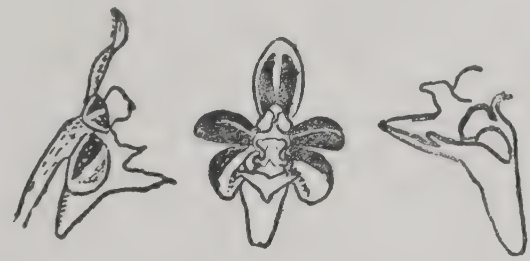
Phalaenopsis Kunstleri × sumatrana.

On May 4th, 1917, Mr. B. K. Saheb brought to the Botanic Gardens for opinion a flowering *Phalaenopsis* which he had obtained in the north of the Peninsula along with *P. sumatrana.* In foliage it exactly resembled *P. sumatrana,* but the flowers were white with a slight green flush, and marked sparingly with chocolate brown. The colouring thus was as in *P. Kunstleri,* Hook. f., but in shape it exactly resembled *P. sumatrana,* while upon the white petals and sepals the shape of the markings was as in *P. sumatrana,* Korth., though they were much less abundantly present. The sepals and side petals had rather the shape of those of *P. Kunstleri,* being shorter and more ovate than in *P. sumatrana.* Altogether there appeared in the specimen a certain amount of evidence for regarding it as a natural hybrid between the two named.

Saccolabium (Sarcanthus) secundum, Ridl.

Saccolabium secundum, Ridl. is a rather widely distributed orchid, occurring in the Himalaya of Assam, and southwards to Sumatra, Java and Borneo. Wallich's collectors, F. de Sylva and W, Gomez, obtained it in Sylhet, and Wallich apparently cultivated

it, for he caused a drawing to be made. Griffith in August, 1836, also obtained it at Sadiya in Upper Assam and made drawings and dissections of the flowers.



Flower of *Saccolabium secundum*, × 2½, viewed horizontally from the side, and from in front: and in vertical section.

Wallich appears to have intended calling it *Sarcanthus oxyphyllus,* but Lindley in helping Wallich with the distribution of his collection, by some accident transferred this name to another orchid, substituting *Micropora pallida,* but confusing two species. Griffith headed his description of the plant *Sarcanthus secundus* and McClelland published it after his death in the *Posthumous Papers* III, Notulae, 1851, p. 362. Ridley, in transferring the plant to the genus Saccolabium, rightly coupled Griffith's specific name into the compound *Saccolabium secundum.*

In 1895 under the editorship of Sir Joseph Hooker, Wallich's drawing was reproduced in the *Annals of the Royal Botanic Gardens, Calcutta,* vol. V, plate 77. Griffith's pencil sketch had appeared in 1851, but the plant as it grows in the Malay Peninsula has deeper colours in the flower than Wallich's plate or Griffith's dsecription indicate for the Assam plant; and they are sligthly differently distributed. The annexed drawing shows its appearance, the black on the sepals and lateral petals representing a very dark chocolate brown, the white a pale greenish yellow. Griffith indicated that the Assamese plant has reddish orange where the Malayan plant has chocolate, and Wallich's drawing bears this out. The lip does not possess these colours, but it is lilac fading to white towards the base with yellow within the side lobes on either side.

The lip combined with the column is a very complex structure through not unique in the genus. The median crest of the limb is extended as a partition down the spur, which divides it almost completely into two, ending about mid length at the back and forming a short beak anteriorly. Above the point where the partition ends at the back is the caruncle which is bilobed and sits astride of the margin of the partition in such a manner as almost to close the way to the interior of the spur. Insects seeking honey must pass a proboscis either to right or to left of this caruncle and find it so directed into one half of the interior only. The honey is very abundant, and the walls of the spur are extremely succulent.

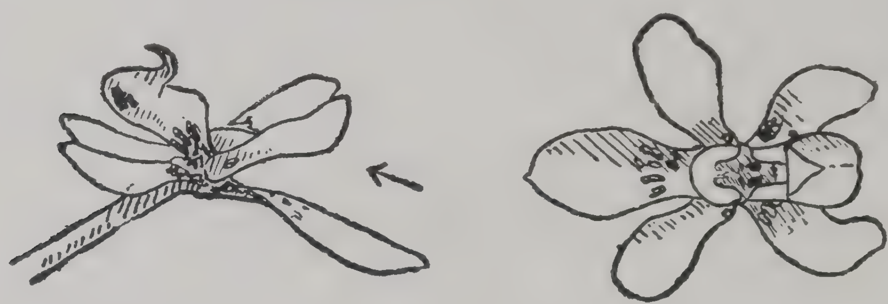
Undoubtedly there is not a little variation in the colouring of the flowers; and Dr. J. J. Smith in his *Orchideen von Java,* 1905, p. 604 states that the sepals and petals may be coloured light or dark brown with greenish blue margin and stripe down the middle.

in the Malay Peninsula as it appears to be found most freely near to the coast.

SACCOLABIUM (POMATOCALPE) ARACHNANTHE, RIDL.

This orchid is one of the group for which Dr. J. J. Smith uses the name Pomatocalpe. A plant of it has been in the Botanic Gardens for a long time and flowered in April, 1916, and in May, 1918. In both years the month of February was dry.

The most curious thing about the flowers is that they face upwards—a rare occurrence in orchids. In the bud they are packed into a corymb. The flowers are white with a very faint lilac tinge, and with a few deep lilac spots towards the base. The edge of the septum which divides the spur from side to side is visible from the front of the flower over the brim of the spur and between the horns at the side, just as Dr. J. J. Smith figures it in *Die Orchideen von Java,* fig. cdlviii, for *Pomatocalpe latifolium.*



Flower of *Saccolabium Arachnanthe*, × viewed horizontally from the side, and from above.

The flowers fade pale green. They are pleasantly but not strongly scented.

The pollinating insects are unknown; but small bees are indicated by the shape of the flowers as suitable visitors; such insects would be expected to alight on the dorsal sepal and to approach the lip between the obliquely ascending lateral petals in the direction indicated by the arrow upon the figure. Such insects would pollinate the flower after having sought in vain for honey in the dry lower chamber of the lip, by backing over the sexual organs, and in the search for the narrow slit like a ⊥ which leads into the smaller upper chamber where the surface may be just moist.

CYPRIPEDIUM NIVEUM × EXUL.

In the Gardeners' Chronicle, vol. 55, 1914, p. 326, Mr. Ridley described *Cypripedium Pereirae,* as almost certainly a hybrid of *Cypripedium niveum* with another species such as *C. Exul.* The native collector, who got it, has brought from the same part of the coast of the Siamese Malay States, namely the coast not far north of the Kedah border, another plant, which, while not exactly *C. Pereirae,* appears equally to be a hybrid of *C. niveum.* The plant in question fell into the hands of Mr. B. K. Saheb who grew it with *C. niveum* and flowered it in June, 1918.

The leaves of this plant are longer and firmer than those of *C. niveum,* attaining 14 cm. by 2.8. They spread and are dark green without the pale spots of *C. niveum,* but the green is nowhere quite of one colour, yet not waved. The tip is slightly unequally bilobed, and the keel at the back sharp. The single peduncle so far produced was about 10 cm. long, and carried one flower; it was densely pubescent, as also the bract, and the ovary. The fused lower sepals of the flower were 2.6 cm. long. The dorsal sepal when flattened was deltoidly subcordate, 3 cm. long and the same in breadth just above the base; but in life its margin was conspicuously undulate. The lateral petals were almost elliptic when flattened, 3.4 cm. long, and in life conspicuously undulate. All these were softly and rather densely pubescent on the back and the margins. The dorsal sepal was marked with lines of violet dots radiating from the base to mid-distance towards the margins, and with a faint lilac flush among the spots. The lateral petals descended but a little from the horizontal, and had a light violet streak right down the centre fading upwards and towards the tip. The rest of these organs was white. The lip was white and glabrous; nearly 3 cm. to the base of the bucket, slightly compressed laterally, longer in proportion to its width that of *C. niveum,* with the basal lobes well developed and strongly incurved. The column was thick, and its shield not at all cordate, but widened to a little beyond the middle, and then abruptly narrowed to a very short point; at its base it was suffused with very pale lilac, and in the centre with chrome yellow.

The chrome yellow comes from its niveum parentage, and so does the absence of isabelline tints in the flower, but the distribution of the violet to lilac colouring matter comes from the other less obvious parent.

It is the rule for hybrids between the white *C. niveum* and the isabelline coloured species of Cypripedium to be white. Many have been raised in gardens and are so; but *C. niveum* × *Exul* has never been raised. All the hybrids carry more or less of lilac pigment, and by its distribution suggest their second parent. In the case of the plant under discussion, the purple markings suggest *C. Exul* as regards the dorsal sepal, and *C. villosum* as regards the laterals petals. But the shape of the flower is more that of *C. Exul* than of *C. villosum;* and the finding of *C. Exul* in the same region almost establishes the parentage.

Further Evidence indicating that the Pigeon Orchid (Dendrobium crumenatum) flowers eight days after Heavy Rain, and on the flowering of Saccolabium Calceolus.

As the Rainfall statistics for the Botanic Gardens, Singapore, through the year 1917 have been given in the last part, it is convenient to make some remarks upon the flowering of the above-named two orchids in its connection with heavy rain, for the data are available for consultation.

In the Gardens' Bulletin, Vol. I, Nos. 11-12, 1916, pp. 400-405, evidence was produced to show that the Pigeon Orchid flowers about eight days after heavy rain in response to some factor or factors not isolated by experiment. The rainfall was there tabulated for thirty days in advance of thirty flowerings which occurred over the years 1913 to the commencement of 1917.

In the wet year 1917, the orchid flowered on an unusual number of days, namely.

January	17th,	freely
,,	18th,	very sparingly
,,	19th,	rather freely
,,	20th,	very sparingly
February	19th,	sparingly
,,	25th,	very sparingly in the Botanic Gardens, but in great abundance in Singapore town
March	20th,	very abundantly
April	13th,	fairly abundantly
June	2nd,	very abundantly
June	20th,	one flower only
July	7th,	rather abundantly
August	11th,	sparingly
,,	14th,	sparingly
,,	31st,	very abundantly,
September	6th,	rather sparingly
,,	27th,	one plant only
November	8th,	very abundantly,
December	11th,	one plant only in the Gardens, but others in the neighbourhood of the Gardens,
,,	25th,	rather sparingly.

It is to be noted how frequent were these flowerings. Then if the reader will turn to the rainfall tables given on pp. 32-33 it can be observed that the rain which fell on the eighth day before six of the flowerings exceeded an inch or on the ninth day before eight of the flowerings, and that in one case only, out of the whole, did the rain of the eighth and ninth preceeding days fail to exceed half an inch; that one case being December 11th, when more than an inch and a half fell on the tenth of the preceding days. If we add together the rain in the way in which it was added on p. 403 of the first volume we find that on the nineteen days which were the tenth before the flowering 10.03 inches fell; on the nineteen which were the ninth 23.62 inches; on the nineteen which were the eighth 15.17, and on the others in approaching order successively 8.19, 6.75, 5.37, 8.97, 7.98, 7.95, and 8.23. Thus the ninth day before is suggested as the critical day rather than the eighth.

The same general result is obtained if the occasions of abundant flowering alone be considered. Perhaps higher average temperatures lead to the eighth day being the critical one; and lower average temperatures to the ninth.

Mr. H. N. Ridley pointed out some years ago that there is a similarity between the flowering of *Saccolabium Calceolus* and *Dendrobium crumenatum,* stating that the former flowers one day before the latter. This relation however cannot be expressed quite so simply. In 1917 *Saccolabium Calceolus* flowered in the Botanic Gardens, Singapore, on

February 24th, one day before *D. crumenatum,*		by the Plant Houses
March 13th, three days before	,,	generally
April 13th, on the same day as	,,	by the Plant Houses
May 2nd		by the Lake
November 7th, one day before *D. crumenatum,*		by the Plant Houses
,, 29th		generally and freely
December 9th, two days before *D. crumenatum,*		generally and freely
,, 18th		by the Plant Houses
,, 22nd, three days before *D. crumenatum,*		generally and freely

This flowering shows the following relationship to the rainfall, t. meaning a trace:—

12	11	10	9	8	7	6	5	4	3	2	1	day	before
.37	.45	.14	—	2.68	.48	.42	.02	—	1.72	1.61	.07	Feb.	24th.
.14	.59	.01	—	2.79	2.66	.79	.09	.02	.02	.92	.08	Mch.	13th.
—	.02	.12	.55	—	.17	—	t	—	.03	2.32	.51	Apr.	13th.
.04	—	.40	—	—	—	—	.02	—	.48	.35	.01	May	2nd.
—	—	—	.01	.38	.02	1.85	.02	—	—	—	—	Nov.	7th.
.01	.16	.03	t	—	.36	.03	.04	.02	—	.06	.07	Nov.	29th.
.06	.07	.63	.01	1.64	.08	.27	.15	.02	.82	.01	.02	Dec.	9th.
.02	.82	.01	.22	1.61	.63	.28	—	.18	.02	.40	.18	Dec.	18th.
1.61	.63	.28	—	.18	.02	.40	.18	.22	.27	.32	.05	Dec.	22nd.

Eight days before the first, second, seventh and eighth of these flowerings the rain was heavy, and on two of the four occasions the flowering was general in several parts of the Gardens. But it was equally free and general on November 29th and December 22nd when the last heavy rain before the flowering had occurred much earlier,—13 days in one case and 11 or 12 days in the other. Therefore although there must be some common cause predisposing the two orchids towards flowering, it is not clear at all exactly what it is. Observations from other localities would be welcome.

I. H. Burkill.

CONTROL OF DAMPING-OFF.

(The following taken from the *Agricultural News,* West Indies, of August 11th, 1917, Vol. XVI, pp. 254-255, is worth reading and digesting; for in Malaya, damping-off in one of the greatest troubles that a gardener has to contend with. The method recommended in it has been tried in the Botanic Gardens, Singapore; and so far there is nothing to be said against it except the necessity of teaching

the ignorant *tukang kebun* to handle the Sulphuric Acid respectfully; and as the use of burnt earth can be avoided in some measure, pecuniary gain is brought into sight).—*Ed.*

Damping-off is the term applied to the failure of seedlings due to their infection while in a tender state by certain soil-inhabiting fungi. The reason for the name is the association of the trouble with conditions of more or less excessive moisture, which favours the development of the parasite at the same time that it increases or prolongs the tenderness of the plants. Though not necessarily confined to seedlings crowded in boxes or seed-beds, it is amongst such that the affection usually appears and, by progressive infection, is able to cause extensive losses. Merely reducing the density with which the seed is sown is often sufficient, by permitting increased ventilation, preventing the drawing up of the seedlings, and making the spread of infection more difficult, to avoid or reduce the damage.

The longer the soil of the seed-bed has been in use and the more decaying animal or vegetable material it contains, the more likely it is to harbour fungi capable of causing damping-off. Heavy water-retaining soils are more favourable to the affection than those which are light and porous, and provision for rapid drainage is one of the most important precautions against it. Over-shading and close shelter, by maintaining humidity, increase the tendency to it; in these respects, as in the supplying of water, the conditions which favour the seedlings favour the disease, and a mean has to be struck between slow growth and loss.

The trouble occasioned by damping-off in these islands (West Indies) is not so great as might be expected by an agriculturist accustomed to temperate countries, where warm, humid weather, such as is associated with ideas of the tropics, is greatly feared in this connexion.

In the first place nearly all the staple food plants, sugar-cane, bananas, tannias, dasheens, sweet potatoes, yams, cassava, are raised from cuttings of one sort or another. Cotton, corn and pulses, which are raised from seed, are planted a few seeds together, in their permanent positions in the open ground. Of agricultural as distinct from garden crops tobacco, onions, and limes, which are raised in seed-beds, have been the plants to suffer most in the West Indies from the affection under notice.

Notes on the subject, embodying the results of experiments conducted in the United States, were published in Volume XIII, of this Journal (p. 380). A bulletin recently received (*United States Department of Agriculture Bulletin, No. 453*), by Messrs. Carl Hartley and Roy G. Pierce, states the conclusions derived from further studies, made on coniferous seedlings.

The authors point out that the methods of prevention commonly adopted by nurserymen, such as the use of sandy soil, the use of sand or gravel for surfacing the beds, the provision of good drainage and ventilation, while often successful, do not avail

to prevent heavy losses under unfavourable circumstances, while the withholding of water often does as much direct harm as the affection which it is sought to avoid.

The use of imperfectly rotted manure, of lime, of wood ashes, and of a mixture of coal and wood ashes are indicated as having had bad effects.

The one means so far discovered which can be relied upon to give satisfactory results under any reasonable conditions is the disinfection of the soil. The question remains as to which of the various methods available for this purpose it is most convenient to adopt. The use of steam or of formaldehyde has been widely recommended, but these methods are so expensive as to be impracticable except for relatively small quantities of valuable material, as in green-houses or market gardens.

For the broader requirements of nurserymen the treatment finally adopted by the authors of the bulletin under review consists in the application in standard soils of three sixteenths of a fluid ounce of commercial sulphuric acid to each square foot of seed bed, applied in solution in water immediately after the seed is sown and covered. This has proved more reliable than the more expensive methods mentioned above.

The amount of water used to carry the disinfectant does not appear to be a matter of importance, provided that the necessary amount of the acid is applied to each unit of area. The quantity used by the authors varies from 1 pint per square foot when the soil is wet to 2 pints when the soil is dry. There is a possibility, especially in light soils, of a concentration of the acid by evaporation to a strength injurious to the root-tips, which in practice has been found to be completely avoidable by watering the beds frequently during the period of germination. When the root-tips have penetrated to a depth of half an inch this is no longer necessary.

There are differences in the amount of acid required for successful results in different soils. In sandy soil which was probably somewhat alkaline, a heavier application, one-fourth to three-eighths of an ounce, was indicated. In a fine sandy soil which was probably already acid, chemical injury to seedlings was more difficult to avoid, and reduction of the acid to one-eighth of an ounce was advisable. On heavier soils the use of five eighths of an ounce produced no injury, and reduced losses by damping-off to less than 1 per cent.

On a soil with a high carbonate content, evidenced by a vigorous effervescense when the acid was applied, the method was found to be ineffective. On this soil the use of copper sulphate, one-fourth ounce per square foot, gave good results. This substance was applied in the same way as the acid, and the same precaution to avoid chemical injury was found necessary.

An interesting indication was given by the experiments of the effectiveness of cane sugar, 2½ oz. to the square foot, in the control of damping-off. The authors point out that if some un-

refined sugar-bearing substance were available, it is possible that for certain soils the application of sugar would become an economically satisfactory treatment. Experiments on this subject might well be carried out in the West Indies.

There are secondary advantages to be expected from sulphuric acid disinfection which may be of considerable importance in some cases. Under appropriate circumstances a larger germination percentage is secured, the number of parasites in the soil is reduced, and the well-known effect of disinfection on fertility results in increased growth. Another valuable effect has proved to be the reduction of weeds owing to the greater susceptibility of their seeds.

In considering the application of the methods to local conditions, it is necessary to emphasize the fact that the results stated have been obtained with the seedlings of a definite group of plants, the conifers. It will be necessary to find by experiment how far they are transferable to the seedlings of unrelated plants. In view of the difference of soils, moreover, such experiments must be carried out in the situation where the seedlings for which it is proposed to adopt the method are raised.

Some hints are given as to the method of handling the acid. It should always be dissolved by pouring it into the water; reversing the process may cause a serious accident. The solution should be made up in wooden or earthen containers and applied with watering cans which have been coated inside with paraffin wax. Boots may be protected by being heavily greased. Wooden containers should be washed out, immediately after use, with water containing washing soda.

W. N.

PROPAGATION OF HEVEA FROM STAKES.

On page 251 of the first volume of the Gardens' Bulletin reference was made to the difficulties experienced in propagating *Hevea brasiliensis* by means of cuttings. Experience in Ceylon and in the Malay Peninsula was quoted; and Mr. Petch's suggestion that Thwaites had been deceived when he claimed it to be easy was cited.

Fresh experiments were then made with cuttings from young twigs, without success; and when it happened, in 1917, that a big wind destroyed many rubber trees in the Economic Garden, stakes were cut from them for supports in the yam beds, so that the misfortune of losing many rubber trees gave the opportunity of trying propagation from branches 1—2 inches in diameter.

These branches were cut diagonally with a sharp knife at the end, thrust into the ground, and wired together at six feet in the way which is seen in Plate VI of the first volume of the Bulletin Nos. 11-12 (opposite p. 394).

Out of a total of 1489 stakes so taken, 18, or 1.21%, took root and produced leaves.

The weather was wet when in January and February the stakes were set in the ground.

I. H. Burkill.

THE ESTABLISHMENT OF THE BOTANIC GARDENS, SINGAPORE.

The year 1919, the centenary of the founding of the settlement of Singapore, brings in the sixtieth year of the Botanic Gardens; and their early history is becoming obscure. Moreover the records are only in the two older Singapore newspapers, which it is laborious to consult, and of which single files exist. These are reasons enough for reproducing here six reports, and for bringing them into one view by a brief introduction, with quotations from the old papers.

The Straits Times under the date 12th November, 1859, has the following paragraph:—

"We understand some of our enterprising citizens have resolved to establish a Floricultural and Horticultural Society, which will receive our hearty concurrence and support. This will be the third attempt to organise a really useful association, and we trust it will succeed."

Who these citizens were is not recorded: but from subsequent papers it appears as if Mr. J. E. Macdonald and Towkay Hoh Ah Kay, better known under his trade name of Whampoa, were two; and it is fairly apparent that the Governor, Colonel O. Cavanagh, had been consulted and had offered his support.

Although called Floricultural and Horticultural in this first notice, Agriculture was in its purview from the very start, its proper title being The Singapore Agri-Horticultural Society.

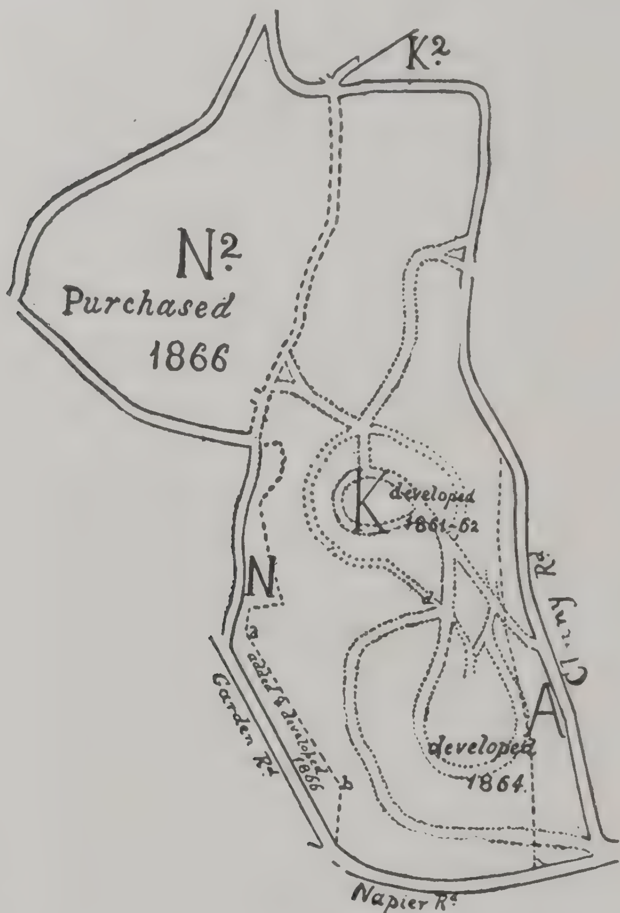
Within six weeks from this notice the Government of the Colony, glad exceedingly that some of its 45,000 acres of abandoned lands should be cultivated, had provided for the Society's operations through an enchange with Whampoa, by giving a piece of low-lying Government land in the River valley to him in return for an area of 56 acres (subject to a subsequent slight rectification) between Napier, Cluny and Garden Roads, the last a track only at the time (Straits Times of 24 Dec., 1859). The Government further promised convict labour within its power of giving: and the Society at once set to work to raise funds for superintendence, stores, tools, seeds, etc.

Members were enrolled on paying $25, and retained membership by a monthly subscription of $1 commencing on January 1st, 1860. Others might enjoy the use of the Garden, if residents, by paying $1.25 per mensem as second class subscribers. Strangers, if not from the very first, at least from an early date, were admitted into the Garden free.

Having got a membership of 77, the Society was provided thus with over $1900 as capital; and the subscriptions, we are told, averaged $74.25 over the first eighteen months (Appendix 2).

The outline map produced here, was drawn with the use of contemporary documents in the Land Office; it gives the whole present area of the Botanic Garden, the Economic Garden excluded, with the three original properties out of which it is made, marked separately

by letters N. K. & A. The areas K. and A. in the map were those which were put at the service of the Agri-Horticultural Society in 1859; the area N. was added in 1866. The chief part of the area of the Garden is seen to be made up of K, which had been granted by the administration in 1852 to one William Graham Kerr.



On the east of this Kerr property was property granted by the administration to one Gilbert Angus in 1848, and on its west property granted similarly in 1853 to one William Napier. When the Cluny road, now a Garden boundary, came to be constructed, it cut through a part of the Angus property, and a part of the Kerr property; the edge of the Angus property, marked A on the map, passed into the same ownership as the Kerr property, while the part of the Kerr property cut off (K2) passed away from the ownership. Again later when the Garden Road came to be made in 1866, it cut a strip off the property of the Napier grant which the administration acquired from Adam Wilson who had bought it from Whampoa and he from Napier, and this strip marked N. on the map, was attached to the land in the hands of the Agri-Horticultural Society. The records show that these lands had changed hands several times within the few years from the original granting; and as we know that in the middle and later part of the fifties, speculation in property about Tanglin was considerable —such landed property as was suitable for country houses,—it is fairly evident that the owners were not in the course of farming what they had come by, but were holding it up for such an

appreciation as accrued considerably in 1856, 1857 and 1858. A surmise only can be made that the southern part of the Kerr property had once been cultivated—say for gambier,—and had reverted to blukar: but virgin forest certainly existed on the northern part, for that forest still persists—a most valuable asset to the Gardens, and there is a little more of it just outside the Gardens on that part of the Kerr property marked in the map K2, which, as said, on the making of Cluny Road was cut off from the rest. The trees growing on both bits of land attest to the forest being primitive: for there are among them such as do not return through blukar, into forest younger than a hundred years. The eye of Sir Stamford Raffles for instance, therefore, saw forest where we see it still. But south of the Bandstand hill there seems to be scarcely a tree which could have been standing in 1860.

We are told (Appendix 2) that the Society spent $1448.10 out of its capital on the clearing of the southern part of the land and on roading.

The first roads made appear to have been what we now call the Office Gate Road and the Ring Roads, the Liane Road, and the Maranta Avenue. The present Main Gate the Society did not make their principal entrance; nor do they seem at first to have made the Main Gate Road. That Road was a later construction, as the abruptness of its junction (at d. on the map) with the first system of drives indicates. The hollow where the lake now is, must have been a swamp down the centre of which the boundary of the Kerr property, (from 1859 to January 1866 the boundary of the Society's property), made the straight line a-b on the map.

Probably for the sake of getting all the influence possible, the Committee was made very large. Fourteen sat on it, with His Honor the Governor as Chairman, and with Mr. J. E. Macdonald as Treasurer: and on September 13th 1860, this large Committee was enlarged to twenty one, five in rotation taking control of affairs along with the Treasurer, who henceforward was to be called Secretary as well.

When the first Committee of fourteen was appointed, and who were elected to it, are unrecorded; but in the first appendix (below p. 64) we find the names of eight who were present at a Committee meeting, together with the names of seven others who were then added to the Committee to make up the number to twenty-one.

Though hoping to benefit local agriculture, the Committee set as its first object the creating of a pleasure garden, as an alternative to the Esplanade, which was then the only resort for the evening drive. The Committee's efforts consequently began by providing a place where a band could play; and the hill top which is 109 feet

*Some trees on the Bandstand hill break the continuity of the terraces, as if spared when the terraces were made; and the southernmost of them are on the west a tree of *Artocarpus rigida*, the Monkey Jack, and on the east a tree of *Artocarpus lanceaefolia*. Everything south of them except the Sagos by the Lily-pond and perhaps two other trees, appears to have been planted since Gardens were laid out.

above sea level was chosen.* Terraces were planned flanking Ring Roads made on it; and through 1861 work upon them was in progress. This is what a visitor from Penang wrote in the Penang Gazette, " I rode over to the new Botanic Garden. By the time it is finished it will be a very nice place. From what I saw of it, part is intended to be laid out in the common terraced English style with drives round the grounds which are of some extent." The Singapore Free Press of January 1862 in reviewing the year then just finished, stated that the progress made in the Garden was considerable.

In 1861, if not also in 1860, a regimental band played in it; so that it had become an evening promenade. The band played once a fortnight (Appendix 2), and the day was at one time a Monday (Singapore Free Press of August 21st, 1862) then changed by public request to a Saturday (Singapore Free Press of September 4th, 1862),—the second and the fourth Saturdays in each month. But it is evident that the terraces were not completed, for in August 1862, work on them was still proceeding (Appendix 2).

It is recorded that in 1862 the Society engaged two Chinese gardeners to grow vegetables, hoping soon to be able to distribute plants and seeds among the members (Appendix 2) ; but reading in the Singapore Free Press of November, 1863 a regret that the Society was not able as yet at that date to supply fruit and vegetables, it is evident that the experiment went amiss.

While the Society's Garden was thus being made, the Society organised Flower shows in the hope of encouraging local cultivation. The first show was advertised in the Singapore Free Press of May 11th, 1861 and July 20th, 1861, and took place upon the Esplanade on the afternoon of Saturday, July 27th, 1861, in a tent " fairly decorated with bouquets of cut flowers from the Garden " and from exhibitors.

A second show was held in December, and others followed in subsequent years.

The Society had obtained the part-time services of Mr. Lawrence Niven as Superintendent. It was easy for him to combine this work with his other work, for he was employed as Superintendent of an adjoining nutmeg plantation; and he asked very little for it. It is quite evident that he did his part well, for he earned the Committee's thanks " for his taste in laying out the Garden " (Appendix 2), and Buckley (Anecdotal History, Singapore, 1902, ii. p. 732) says that he made the Garden attractive by large beds of pretty flowers; and further praise is given to him in the Gardens' Guide published in 1889.

The Government provided ten convicts for the Garden; and they were housed in lines built, if not at the very first, at least before 1866, up against the Napier property where the Lake now is. The Committee employed a further ten men, and added again another ten in 1863 in order to push on the work. But the expense of this free labour was more than the normal revenue of the Society could

* There is a point in the Gardens jungle recorded as 108 feet above sea level; and the Director's house is recorded as at 116 feet.

bear; whereupon thirty-one members came forward with donations of twenty-five dollars each (Appendix 3), and then again in the next year another fourteen members (Appendix 4). The further to add to the Society's funds a Fancy Fair was next organized in conjunction with a Flower Show, which took place on December 28th, 1864, and then again another Fair was held in 1866.

Although a hope had been expressed of dispensing with the second gang of ten free labourers, the report for 1864 (Appendix 4) shows that 17 men were being employed under a mandor, and that the Government had been able to increase the number of convicts to fifteen. It was under these circumstances that the second fourteen subsidiary donations were given.

The Bandstand Hill at the end of 1862 or in 1863 had become so far transformed that it was decided to turn attention towards the southern corner and to construct a new entrance "at the nearest part to town" where the present Main Gate stands. The Society somehow still possessing a little bit of land, cut off from the Kerr property in the making of the Cluny Road, and for that reason of no real use to them, exchanged it for considerations with the Nassim estate, one of which was that a corner of Nassim land should be thrown into the Napier and Cluny roads at their junction in order to improve the approach to the new gate. This was done.

The realignment of Garden Road had meanwhile been under the consideration of the Government, and as its construction promised to add a narrow strip to the Garden along its west edge, the making of the Lake, as it now is, became possible. This possibility may have been foreseen for two or three years, for the Main Gate Road which runs along the Lake bank had assuredly been laid down when in 1864 the new gate was opened, and there are no signs of any subsequent realignment to fit its course to the lake; but that the Lake was not part of the plans made in 1860 must be the case, for all the land was not in the Society's possession, and the Main Gate Road which takes visitors to the Lake, as said on p. 57, was not in the first plans. The Gardens were in fact laid out in four stages, each more or less independent; first there was the Band promenade with an approach from Cluny Road, and a means of driving through to the Rogie gate or the Garden Road; next, hinged on to the Bandstand to its south, was made the Herbarium Ring Road and its connecting paths, very carefully and symmetrically planned; then came the Main Gate, with its road; and lastly came the Lake, depending for its existence upon the acquisition from Adam Wilson in January, 1866, by Government of a bit of the Napier property. The Government supplied convict labour for work on the lake; but this had to be supplemented by free labour (Appendix 5).

Meanwhile Lawrence Niven found that the service demanded from him by his growing charge was inadequately paid for, and asked for more than he was receiving. The Committee considered it his due, but not feeling certain of having the means of granting it; they applied in August, 1865, to the Government for an allowance of fifty dollars per mensem, being the amount that they found

would retain Niven; and the Government sent the application forward to India for favourable consideration. A long interval passed with no reply, and the Society becoming very insistent, the Governor took it upon himself 13th July, 1866, to grant the sum asked for with effect from May 1st, 1866, subject to approval, only to find himself overruled from Simla by an order which he received the very next day. Yet somehow the Society did get this grant of $50 and in the same year, it being the first direct payment on the part of Government to the Gardens (vide Appendix 5).

There is a statement appended to the report of the Society for 1866 which is not reproduced here, wherein the names of the members of the Society are given and the amounts of their donations; we learn from it that 133 had joined, paying their $25 entrance fee and some of them giving another $25 later. We know that 77 of these were original members or members who had joined in the first year, and that 9 new members were obtained in the first half of the second year. If we distribute the balance of 47 over the remaining five and a half years, say thus, 5 for a half year, 8, 8, 8, 9, and 9; and collect together the other declared sources of income, assuming this only that the first Fête brought in $1000, we find that the Society obtained funds as follows:—

year	entrance fees	special donations	proceeds of fêtes	subscriptions, gate money, etc.	Total as recorded
1860	$1925	$—	$—	$624	$2348.75
1861	350	—	—	1296	1646.50
1862	200	—	—	985	1185.50
1863	200	775	—	945	1920.00
1864	200	350	—	1335	1884.75
1865	225	—	1000	2140	3364.62
1866, 10 months only	225	—	1717	3135*	5079.41

The increasing figures were evidently held by the Committee as justifying larger expenditure: they considered that they were beginning to get a return on their outlay, and would on a yet larger outlay. The Governor, moreover, in his Progress Report (dated 1867) remarked the taste in which the Society's land had been laid out. With a great faith in their mission, they proceeded to stabilise the undertaking; they raised Mr. Niven's pay again to retain his services (Appendix 5); they obtained from Government a grant in perpetuo of the land§ which they had been holding by its goodwill, so long as it should be used for public purposes; and to provide a site for a house for their Superintendent, and for other purposes they bought on March 9th, 1866, upwards of twenty-five acres of land† of the old Napier estate from Adam Wilson, who had bought it from Whampoa,—the land N2 on the plan. This exhausted their funds, leaving nothing for building: but they raised $1500 by a mortgage (Appendix 5).

* includes $250 from Government *i.e.* $50 p.m May to September.

§ 55 acres 3 roods and 28 poles.

† 24 acres 1 rood and 19 poles.

Up to this date the Society had had two Secretaries, firstly Mr. J. E. Macdonald, and secondly Mr. E. J. Leveson. Both had somehow through considerable difficulties, procured funds for the Society's Garden, and worked most assiduously, especially the second. From its foundation to 1867, when he retired, Major-General Cavanagh had showed the greatest interest. He took the chair at the meetings and was active with all the help he could give. The public to this date had put $17,430 into the creating of the Garden. The third Secretary Mr. C. H. H. Wilsone was not so fortunate. He entered into a contract* in 1867 with a Chinamen for the building of a Superintendent's house,—now the Director's house,—for the sum of $2400, and left the Society with a debt of over $700 being largely the difference between the sum raised by the first mortgage and the cost of the house. The last appendix here printed shows that in his non-extant report for 1868 these debts were overlooked, and a very false idea of security presented.

The Committee in 1869 when they realised their position asked and prevailed on the Government to allow them one hundred dollars monthly instead of fifty: and Sir Harry Ord, who was Governor, made a bargain that in return the Society should exhibit in the Garden living economic plants; for he had noticed that travellers making but a short stay would seek in vain for gambier, pepper, and other similar useful objects whose cultivation was no longer carried on near to the town. The better to watch the spending of the increased grant, which, consequent upon the falling off of subscriptions made 43 per cent of the Society's income, the Governor decided to appoint a member on to the Committee officially and chose Mr. H. F. Plow, Clerk of Councils, to represent him. At the same time he suggested the formation of a Zoo as an additional and educational attraction, like the economic plants: and he offered to present some animals.

The transactions of the years which follow between 1870 and 1874 are obscure, because the Agri-Horticultural Society went to sleep again. In a speech upon the Budget for 1875, made on December 18th, 1874, and reported in the Singapore Daily Times, of December 24th, 1874, Dr. R. Little stated that the Society had not carried out its part of the compact with the Government to grow economic plants, and that Committee and Management had alike lost interest. The Committee indeed had failed to raise adequate funds, except by increasing the 8% mortgage on its property to $4000. When in August 1874 this had been run through and the Treasurer found himself with a very adverse balance, a meeting was called which resolved:—"That the Honorary Secretary be instructed to acquaint Government with the willingness of subscribers to hand over the Agri-Horticultural Gardens for future maintenance, reserving to subscribers the same privileges that they now enjoy." This resolution Mr. R. Campbell, as Secretary, forwarded to the Colonial Secretary on August 13th, 1874.

Three months earlier, on May 14th, 1874, the subscribers to the Raffles Library had passed a similar resolution, praying the Government to take over their property with their debts, and to

* The specifiation and approximate plans are in the Gardens' records.

maintain the Library: and this request the Government had acceded to, and had appointed a very strong Committee, with Dr. Robert Little as Chairman, and Dr. N. B. Dennys as a member, to carry on. The Government, it happened, had been asked just before this by the Secretary of State if their control over the Library and over the Gardens was at all commensurate with the large sums of money that were being spent (at the time mostly on the Library). Change thus came from two sides: for both institutions had asked the Government to take them over; and of both institutions the Secretary of State had enquired if the Government was controlling them. The subscribers to the Library had acted first: the change was made promptly, and the new Committee immediately got under way. They engaged the services of a Dr. James Collins, who had come eastwards with recommendations from the Secretary of State, Sir Joseph Hooker and others, on a salary of $150 per mensem, to travel and investigate, to collect for the Raffles Museum; and to his duties was added that of getting together objects for an Exhibition in London: at the same time he was to carry on the Committee's correspondence, accounts, etc., in Singapore. Then when the members of the Agri-Horticultural Society made their petition, the Governor requested this Committee, if they could, to take charge also of the Garden; and they consented to do so. Thus the Garden passed temporarily under the same control as the Raffles Museum.

We find in the speech made upon the Budget estimates for the next year by Dr. Little, already referred to, and in some letters preserved in the Library the Committee's proposals for the future. Dr Little in these explained that it would not be advisable to add to Dr. Collins' work, but that another officer should be obtained from Britain, who could join Dr Collins in his explorations, the results of the two working together, bringing "immense gains to the scientific world."

The Governor now advised the Secretary of State that legislation would be necessary, for the Garden was property vested in the Vice-President and Treasurer of the Agri-Horticultural Society, and therefore could only be held for them by the Raffles Library Committee; and an act was needed that they might be transferred completely to the Government. For the purpose one was drafted immediately, but not put through. Meanwhile reorganisation was commenced; on the recommendation of the Committee, Government agreed to the retention of Mr. Niven on his pay of $80 per mensem with the title of the Manager, giving him permission to undertake besides their work other business; and the proposed Superintendent was sought from England by the Committee in correspondence with Sir Joseph (then Dr.) Hooker, as Director of the Royal Gardens, Kew. This Superintendent, the Committee stated, was to be a practical as well as a systematic botanist, and to travel in the Malay Peninsula not a little for the purpose of investigating its vegetation. At the same time an officer, found locally, was appointed to the charge of the animals in the Garden. Dr. Little obtained in the place of the sum of $1200 which was passed by the Government in the estimates of 1870, 1871, 1872, 1873, and 1874, as a grant to the

Botanic Garden, in 1875 $11,324; and in the three years following the Government budgeted annually $7580 for the Botanic Garden and $2400 for the Zoological Garden.

In the Singapore Daily Times for December 19th, 1874 and for the following days, there may be found an advertisement of the taking over of the Garden by the Government and of it being open now to all under the rules given, the right to receiving cut flowers, etc., being reserved to the subscribers within the Garden's means of supplying them.

At this date the Garden they may well have been quite a pleasant place to wander in,—a park in fact, but they had no scientific value whatsoever, for the number of species of plants cultivated was about 500 (Guide, 1889) and the animals were only a small collection of birds. The Society had lost way, though in the few years before they had been useful at times to the Government for the supplying of seed-coconuts to Mauritius and of seed of cocoa, cloves and pepper to Queensland, in answer to official requests from those colonies; but it would seem that the staff of the Garden collected what was needed from outside; and the Garden itself played no part in the service.

Then to the Library Committee in answer to the request for a Superintendent, Sir Joseph Hooker sent out an energetic, but very young man, in James Murton, who, arriving in Singapore in October, 1875, with a large supply of new plant-introductions, chiefly from Ceylon, converted with these and with later supplies from Kew, Mauritius, Brisbane, etc., the Agri-Horticultural Society's park into a working Botanic Garden; while William Kröhn, employed by the Committee, built up the collection of animals. Lawrence Niven now took leave, and died while away. His work,—the landscape gardening and terracing,—had been well done, so well done that little has been altered since: whether the plans were his entirely, or were not, is unrecorded: but it is evident that he greatly influenced them: and the smallness of the pay given to him suggests that he undertook the work largely for the love of it.

I. H. Burkill.

APPENDIX 1.

From the Singapore Free Press of 13th Sept, 1860.

A meeting of the Committee of the Singapore Agri-Horticultural Society was held on the 28th ultimo, the Honourable the Governor, President of the Society, being in the chair. The following members were present:—Messrs. J. d'Almeida, C. H. Harrison, Whampoa, C. R. Rigg, J. E. Macdonald, M. F. Davidson, and Capt. Burn. The Treasurer's accounts, showing a balance of $36.49 in favour of the Society, having been examined and passed, the following resolutions were adopted:—

1. That the Treasurer be requested to collect the monthly subscriptions from the 1st January last and in future that they be collected quarterly in advance.

2. That the members of the Committee be augmented to twenty one members, and that the following gentlemen be requested

to act so as to make it up to that number, viz. Messrs. Jose d'Almeida, James Murray, Tan Kim Seng, W. Paterson, W. Mactaggart, J. H. Campbell, and C. H. Wilsone.

3. That the Committee be divided into four Subcommittees who will by turns undertake the general management of the Society for three months at a time, and that the following gentlemen be requested to form the first Subcommittee from the 1st September next:—Messrs. C. H. Harrison, M. F. Davidson, C. R. Rigg, J. d'Almeida, and Captain Burn.

4. That the Committee as early as possible put themselves into communication with the Botanical and other Societies of Calcutta, Batavia, Mauritius, Penang, and other places for the purpose of obtaining supplies of plants and seeds.

5. That a Show of Flowers, Vegetables, and Fruit be held in March next, and that the Subcommittee for the time being make arrangements for the same.

6. That to enable the Society to avail itself of a gang of convicts as sanctioned by the Government, the necessary accommodation be provided for their reception within the limits of the Garden.

7. That Mr. Macdonald who has so kindly acted as Treasurer to the Society since its formation be also requested to undertake the duties of Secretary,—a combination of the two offices being considered desirable.

8. That Messrs. Whampoa and Tan Kim Seng be requested to afford the Society their valuable assistance in inducing their countrymen in Singapore to join the Society.

9. That each successive subcommittee on being relieved be requested to furnish a brief report of their proceedings to be laid before a quarterly committee meeting.

APPENDIX 2.

From the Singapore Free Press of August 15th, 1861.

This being the first general meeting since the formation of the Society in November 1859, the Committee of the Society desire to report proceedings to the Subscribers.

There are now 67 first class subscribers and 8 second class subscribers. Since the formation of the Society, 19 first class subscribers and 1 second class subscribers have withdrawn or left the Settlement. In the above 67 there are 9 new members since the commencement of the year.

From the account current to 30th June, produced by the Treasurer, there appears to be a balance on hand of $167.01.

The monthly income from subscriptions is $74¼ while the expenditure has averaged $176 per month, for a period of 18 months. This sum, however, includes $1,448.10 paid for contract work for clearing land, making roads, and erecting gate-posts, and bridges, leaving about $90 per month to the general working expenses of the Garden, being an excess of expenditure over receipts of 15¾ per month. The bringing of the Band to the Gardens once a fortnight

involves an outlay of $14 per month, but your Committee think that it is advisable to continue this expense, as the presence of the Band is a source of attraction to a considerable number of the community, and has added somewhat to the number of subscribers, and it is expected it may be the means of adding still further to the number.

There are now employed on the Garden a mandore and 10 coolies, and the Government allows a gang of 10 convicts. The quantity of work performed may appear to be less to the subscribers than they may have expected from the number of men employed, but the heavy nature of the work, which has consisted mainly of the formation of the very extensive terrace near the bandstand, fully accounts for this.

The first show was held on the 27th July, and although the products shown were not numerous, they were certainly as many as could reasonably have been expected. As a first attempt, and seeing the interest taken by the natives on this occasion, your committee are sanguine that much good will result from it.

Two Chinese gardeners have lately been engaged for the purpose of cultivating vegetables under the Superintendent, and it is hoped that in a few months the sale of vegetables will be a source of profit to the Garden, as well as a stimulant to men of their nation to rear a better cultivated vegetable; and to introduce a greater variety than the European community have hitherto enjoyed.

Your committee are much indebted to Mr. Niven Jr. for the taste displayed in laying out the Garden, and for the attention he has given generally.

Supplies of seeds have been received from the Agri-Horticultural Society of India, and also from England and from the Botanical Gardens of Batavia. Two boxes of plants and orchids and several contributions have been made by residents. And your committee hope ere long to be in a position to distribute plants and seeds among the subscribers, and cannot conclude this their first report without congratulating them on the success of the Agri-Horticultural Society of Singapore.

APPENDIX 3.

From the Singapore Free Press of Nov. 19th, 1863.

A general meeting of the Agri-Horticultural Society was held on Thursday the 12th instant (November 12th, 1863) at the Exchange Rooms, His Honor the Governor in the chair.

The Honorary Secretary read his report and the same was passed and approved.

The Treasurer submitted his report showing a balance in favour of the Society of $284.92, out of which the expenses of November and December have to be paid.

He at the same time brought to the notice of the meeting that out of 95 original members 4 have left Singapore, of these remaining 31 have already paid a second donation of $25 and this payment alone has prevented the Society from becoming insolvent.

The total income for the first half-year was $634.50 and the expenditure $762.42 showing a deficit of $22 per month, whilst for the current half-year the income is likely to be $522 and the expenditure $822 showing a deficit of $50 per month. This deficit has been mainly caused by the 10 extra coolies which it has been necessary to retain in order to complete the work now in progress. These however will in all probability be discharged early next month when the income is likely to be nearly enough to cover all Expenditure with the exception of the carriages for the Band.

The Treasurers report was then passed and approved.

The following resolutions were then proposed and carried.

1st Resolution—Proposed by Joachim d'Almeida, Esq., seconded by Captain Protherce.

That the following Gentlemen be requested to form the Committee for the ensuing year:—

Jose d'Almeida, Esq., C. P. Lalla, Esq., Captain Macnair, J. Murray, Esq., C. R. Rigg, Esq., D. Rodger, Esq., H. M. Simons, Esq., Syed Abdulla, Esq., Tan Kim Ching, Esq., Whampoa, Esq., E. J. Leveson, Honorary Secretary and Treasurer.

2nd Resolution—Proposed by H. M. Simons, Esq., seconded by J. d'Almeida, Esq.

That an application be made to the Government in hopes of being able to obtain further assistance in the way of Convict Labour.

3rd Resolution—Proposed by the Honourable the Resident Councillor, seconded by Captain MacNair.

That with a view of increasing the members the monthly payment of the Second Class Subscribers be reduced to 50 cents, and the privilege hitherto granted to the Public of resorting to the Society's gardens on 3 days a week be withdrawn and the Gardens hereafter to be open only to Members, Subscribers, and Strangers, and Messrs. J. Little & Co. are kindly requested to receive Subscriptions and Donations.

4th Resolution—Proposed by H. M. Simons, Esq., and seconded by E. J. Leveson, Esq.

That the best thanks of this meeting be voted to His Honor the Governor for his kind assistance in taking the chair and for his valuable suggestions.

APPENDIX 4.

FROM THE SINGAPORE FREE PRESS OF NOV. 17TH, 1864.

The annual meeting of the Members of the Agri-Horticultural Society was held at the exchange rooms on Thursday November 10th, 1864.

The Honourable Colonel Orfeur Cavenagh, Governor of the Straits Settlements, in the chair.

The Honourable the Governor read the annexed report of the Hon. Secretary and Treasurer.

After some preliminary remarks from the Chairman, the following resolutions were put to the meeting and carried unanimously.

1. Proposed by the Honourable the Governor, seconded by H. M. Simons, Esq.

That the accounts and report of the Honorary Secretary and Treasurer be passed and confirmed.

2. Proposed by the Honourable Col. Macpherson, seconded by C. H. Wilsone, Esq.

That the following gentlemen be requested to form the Committee for the ensuing year.

S. J. G. Jellicoe, Esq., C. P. Lalla, Esq., Captain Macnair, Captain Mayne, J. Murray, Esq., D. Rodger, Esq., H. M. Simons, Esq., Tan Beng Swee, Esq., Lieut.-Col. Warden and Whampoa, Esq.

3. Proposed by the Honourable the Governor, seconded by the Honourable Col. Macpherson.

That E. J. Leveson, Esq. be requested to act as Honorary Secretary and Treasurer for the ensuing year.

4. Proposed by the Honourable Col. Macpherson, seconded by E. J. Leveson, Esq.

That the proposition of the Committee to increase Mr. Niven's salary to $50 per mensem be carried out.

5. Proposed by H. M. Simons, Esq., seconded by J. S. Atchison, Esq.

That this meeting approves of the decision to hold the proposed Fête and Fancy Fair at the Mess House, Tanglin, in preference to the Gardens.

6. Proposed by H. M. Simons, Esq., seconded by Lieut.-Col. Warden.

That the best thanks of this meeting be presented to His Honour the Governor for taking the chair, and for the kind assistance he has always rendered, and the interest he has always taken in the Society.

Report.

The current account to the 30th June last, shows a debit balance of $66.76, and that to the 30th of last month, a balance in favour of the Gardens of $366.15, which will cover the ordinary expenses to the end of the year.

At the last annual meeting it was proposed to reduce the 3rd class subscription to 50 cents per month, but as this arrangement was not availed of to any extent, the committee decided to give up the 3rd class subscriptions altogether.

The monthly income from subscriptions during the first six months averages $100, and the expenditure $151, and during the present half-year the subscriptions have amounted to $144 against an expenditure of $184 per month. To meet however, the surplus of expenditure over income there have been fourteen donations of $25.

The officers of the 34th Regiment having kindly volunteered to subscribe $80 a year to the Society, the Committee felt justified in asking them to allow their Band to come again to the Gardens once a fortnight, a boon which has been highly appreciated by the subscribers.

We have now one mandore and 17 coolies employed regularly in the Gardens, and the Government allow 15 convicts, part of whom are employed in laying out the new grounds.

Mr. Niven has been unremitting in his attention and superintending the Gardens generally. He has shown great taste in carrying out the improvement going on, and it seems now quite time for the Society to show their appreciation of his services by an increase of salary, his present one being barely sufficient to cover the expenses consequent on his daily attendance; and the Committee recommend that his salary be increased to $50 a month. Considerable attention has been paid to the drainage, and a new grand entrance has been commenced at the nearest point to the town, the whole of which expense has been borne by the Government.

A strip of land belonging to the Nassim estate, and bordering on the Gardens has been exchanged for a similar piece of ground which formed part of the Gardens, but was of no use as it lay on the opposite side of the road, and to enable us to widen the principal approach, the Trustees of the Estate kindly allowed the corner of the Castle property to be thrown into Napier and Cluny Roads.

Although the residents have subscribed very liberally to the Gardens, it was found impossible to complete the laying out of the new ground without further means, and the Committee therefore have decided to hold a Horticultural Fête and Fancy Fair on the 28th of next month, when they expect that a considerable addition will be made to the funds of the Society.

In addition to promised contributions from the residents of Singapore, orders have been sent to Europe, India, China, Manila, and Japan for articles for sale the outlay for which, amounting to $1000 has been guaranteed to the Treasurer by the Committee.

APPENDIX 5.

From a Printed Paper Distributed to the Members of the Society in 1866.

Proceedings of the Annual Meeting of Subscribers.

The Annual Public Meeting of Subscribers to the Singapore Agri-Horticultural Society was held in the Exchange Rooms on Monday, November 19th, 1866.

The Hon'ble the Governor in the chair.

The Report was read by the Hon'ble the Governor.

Proposed by the Hon'ble the Governor, seconded by W. Paterson, Esq., that the Report now read and the Treasurer's accounts be passed and confirmed,

Proposed by Captain Protheroe, A. D. C.; seconded by Jose d'Almeida, Esq.; that the following gentlemen form the Committee for the ensuing year.

Brigadier Ireland, Colonel Cooks, J. Bennett, Esq., Hoh Ah Kay, Esq., F. van der Heyde, Esq., J. Murray, Esq., D. Rodger, Esq., S. J. G. Jellicoe, Esq., C. H. H. Wilsone, Esq., W. B. Smith, Esq.

That this meeting records its hearty thanks to Mr. Leveson for his services as Secretary and Treasurer of the Society, and requests Mr. Wilsone to act in that capacity for the ensuing year.

Proposed by D. Rodger, Esq., seconded by J. S. Atchison, Esq.

That the Vice-President and Treasurer of the Society for the ensuing year and their successors be and they are hereby appointed Trustees of the Society.

Proposed by E. J. Leveson, Esq., seconded by J. Cameron, Esq. and carried with acclamation.

That the best thanks of this meeting be given to His Honour the Governor, for his presence at this meeting and the interest which he has always taken in the welfare of the Society.

Annual Report of the Singapore Agri-Horticultural Society for 1866.

The extensive improvements in the Gardens and the expenditure requisite for completing the lake, having necessitated a considerable outlay, the members will be aware that at the last annual meeting it was decided to hold a second Fête and Fancy Fair, which was accordingly done in the month of May last and the result again proved very satisfactory, the net profit to the Gardens being $1717.21;—and the Committee takes this opportunity of thanking the members and their friends, particularly the ladies, for their kind assistance and support on that occasion.

The Committee have great pleasure in informing the members and subscribers that the Government has been pleased, on application, to grant $50 per mensem towards keeping up the Gardens, which will be of material assistance, seeing that the income of the Society only averages $120 per mensem owing to a falling off in donations and subscriptions.

From a statement which is laid before you this day it will be seen that no less a sum than $17,429.78, has been voluntarily raised in Singapore since the formation of this Society in 1860, of which amount $3749 have been Donations, and, as a great part of that amount has been necessarily devoted to laying out the grounds, which will ere long be completed, the income will in future be available for the actual development of Horticulture and Agriculture.

The Government has kindly allowed the services of 60 prisoners from the House of Correction to carry out the excavation of the lake, but owing to the small number of prisoners in Jail not more than an average of 30 have been available, and of late not more than

10, so that your Committee have been obliged to contract for Chinese coolies to complete the excavation; it is however highly probable that in the course of a week the number may be increased to 25, in which case, as the sluice to let off the water is to be commenced at once, the Committee expect that the lake will be ready to be filled by the end of the year; meanwhile the land on both sides is being tastefully laid out by the able Superintendent, whose exertions have been most meritorious, and Garden Road has been entirely re-metalled, and again opened to the public.

As the lake occupies the only situation where the Coolies employed in the Gardens can live, and as a residence is required for a Superintendent, your Committee have bought the adjacent property, lately belonging to Adam Wilson, Esq., for $1,700 and empowered the Trustees to raise $1,500 on mortgage of the newly acquired land and Superintendent's house to be erected thereon, which has been carried out accordingly.

To construct the Superintendent's house, the Government have kindly consented to allow the Society to be supplied with Bricks from the Government kilns at cost price, and as there will be no immediate necessity for the payment until the Society is in a position to make it, a contract will at once be entered into for the building.

One of the intentions of the Society being to supply members and subscribers with European vegetables, and "to secure improvements in the vegetable products of the island," part of the newly purchased property has been already planted, and as soon as regular fresh supplies of seeds now on the way begin to arrive your Committee expect to be in a position to carry out the object in view.

The plan of the Gardens is now complete, and the titles have been duly received from the Government and are laid before you.

To enable a Government Grant of the land to be made out it was necessary to have two trustees, and consequently your committee have appointed the Vice-President and Treasurer of the Society for the time being, and their successors, in that capacity, which appointment you will be this day asked to confirm.

The Treasurer's accounts are laid before you, showing a balance at credit on the 1st instant of $1,479.44, and the same are submitted to you for confirmation.

It has been brought to the notice of your Committee that some of the residents of Singapore who are not subscribers avail themselves of the Gardens of the Society, although they must be aware that only Members, Subscribers and Strangers have the right of admittance, and the Committee trust, as the funds of the Society depend chiefly upon subscriptions, which just at present are much needed, that all will see the necessity of lending their aid.

The Committee take this opportunity of expressing their thanks to the Government for the ready assistance which has been invariably given whenever asked for.

In conclusion your Committee beg to state that in consequence of the great satisfaction Mr. Niven has given in the discharge of his duties as Superintendent they propose to increase his salary to $80 per mensem from the 1st of January next.

APPENDIX 6.

From Manuscript, being the Draft of a "Report to be Presented to the Society at a Meeting of Feb. 24th, 1870."

At the last general meeting held on the 2nd June, 1868, the late Hony. Secretary stated that the income of the Society for the ensuing year might be considered fully equal to $200 per month, which would be sufficient for all current expenses; but Mr. Wilsone appears to have forgotten that a large balance was still due to the builder of the Superintendent's house, which with other items of expenditure already sanctioned ultimately amounted to $722.57, and it soon became apparent that the revenue would fall far short of the necessary expenditure.

Under these circumstances your Committee found that the Society was rapidly getting into debt, and that either some means must be devised to increase the revenue or a portion of the Gardens must be allowed to relapse into jungle.

It was considered inadvisable to raise the rates of the annual subscriptions, these being already as high as people are likely to pay, and it was feared that subscriptions would decrease rather than be augmented thereby.

At the same time it was not deemed proper to resort to the means of a Bazaar, as had been done formerly to raise extraordinary sums for special purposes, as the Gardens might now be considered so far complete that a true estimate could be formed of the annual expenditure, and this should be provided for in some way permanently, as no committee could take upon themselves the responsibility of providing funds annually by such precarious means as Bazaars.

It was therefore decided that as the public voluntarily subscribed as much as they could afford, the Government should be requested to increase the then small grant from $50 to $100 per month, and after some correspondence upon the subject the application was favourably considered by the Legislative Council and the extra grant conceded, with the condition that the Government should nominate one official member of the committee, which was readily acceded to and H. F. Plow, Esq., Clerk of Councils, has been duly appointed accordingly.

Your committee in applying for the increased grant expressed their intention of making the Gardens more generally useful; by keeping a nursery of flowers, plants, shrubs, etc., and also raising European vegetables for distribution to members, subscribers and others, and they regret that circumstances have so far prevented them from more than partially carrying out their views, but they expect in the course of the current year to be able to effect all these objects successfully.

By the accounts now laid before you it appears that the gross receipts of the Society during the 18 months between 1st July, 1868, and 31st December 1869, amounted to $4420.86 and the expenditure to $4396.06 showing a balance of $24.80 to the credit of the Society. The income for the next twelve months is estimated as follows, viz:

Subscriptions about	$1600
Government grant	1200
	$2800

and the expenditure for Superintendent's salary, wages, etc., at $2520 leaving a small balance for contingencies and for further improvements in the Gardens.

During the last 18 months the Society has corresponded with and supplied plants to the Gardens at Saigon, Mauritius, South Kensington, etc., and thanks are due to Captain Caldbeck and the P. and O. Company for their kindness in carrying boxes of plants and seeds both ways free of charge, and also to Dr. Scheffer. Director of the Botanic Gardens, Buitenzorg, for the gift of many valuable and interesting plants.

H. E. the Governor having offered to present a certain number of wild animals to the Society in case they should be disposed to form a Zoological collection in the Gardens, your Committee considered the question too important to be settled by them alone and have therefore intimated in the advertisement calling this meeting that they would submit the matter to the whole body of members and subscribers, and you are now invited to decide whether you consider such a course to be practicable and advisable.

Rubber tree No. 1844, the tree with dark bark, at the foot of which the man stands.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. II. Issued July 4th, 1919. No. 4.

HEVEA *VERSUS* FUNGI.

It has long been a commonly observed fact in the history of many crops that at first, with only small and isolated plantings, there is likely to be little if any trouble with diseases and pests. This has often resulted in giving planters ill-founded hopes and false assurances as to the future. As the area planted is extended and large sections of country become occupied with the crop, endemic fungi and insects gradually become adapted to it, and others slowly filter in from abroad. The latter occurrence is quite inevitable in new countries since the people of such countries cannot be convinced of the necessity of strict plant quarantine regulations efficiently administered, until driven to it by bitter experience—too late.

Hevea is a conspicuous case in point. A large number of fungi have become adapted to it in oriental plantings, and so far as production alone is concerned, fungi will constitute the limiting factor. It is perfectly characteristic of human experience and human failings, that planters and government administrators cannot be expected to become fully alive to the problems involved and the necessities of the case, until staggering losses have been suffered, or until wholesale infection has occurred. It was only after the coffee industry of Ceylon and Java was doomed that effective work began in the study of the Coffee Rust. It was only after thousands of acres of fine Florida orange groves were destroyed that people awoke to the importance of the Citrus Canker, as a limiting factor in citrus culture. Verily, we are anxious enough to lock the barn after the horse is stolen! But it is not *always* thus! The U. S. Department of Agriculture now has Dr. Weston—an able pathologist—stationed for a year in the Philippines to study the highly destructive oriental corn mildew. Why should this great expense be incurred when there is no corn mildew in the United States? *Because the corn mildew is not wanted there, and because, if it should by chance get there, it may be met with full understanding!* In this manner, active work is not only being done

at home, but in all parts of the earth, for the protection, present *and future,* of American agriculture.

A great industry like rubber growing representing investments of millions of pounds should be adequately protected. This means thorough and *timely* investigation of every possible prime factor and every related subsidiary factor touching the growing of rubber. It also means the employment of a large force of active and highly trained specialists and the establishment of numerous well equipped laboratories. The Hawaiian Sugar Planters have profited extensively by such an organization. The American Rubber Company in Sumatra evidently intends to do so.

The investigation of rubber diseases has usually proceeded by certain stereotyped methods. From diseased tissue, pure cultures are started in artificial media, the resulting growths inoculated into healthy tissue and the disease reproduced. The vegetative form at least of the specific organism is thus isolated, and then attempts are made to secure the spore bearing form in pure culture, to determine its identity and to determine the original sources and methods of infection. Unless all of this can be accomplished it frequently follows that effective sanitary and remedial measures are impossible to devise. Many fungi refuse to produce their spore-bearing forms in any ordinary artificial culture. However, all of these fungi will fructify freely under certain natural conditions. The perfect form of a certain serious apple disease was not known until finally discovered on small withered and weathered apple-mummies that lay on the ground beneath the tree. Numbers of other important cases of the sort might be cited.

It follows, therefore, that there is another important avenue through which these problems should be approached, and which is usually largely neglected. *Every fungus* growing on or in connection with rubber trees *should be known and its relation to this important crop thoroughly understood.* It is commonly the case that parasitic fungi produce spore bearing forms only after the affected tissues are dead and then, frequently, only under certain natural conditions. It follows that every fungus fruiting on dead Hevea must become an object for investigation. It is not safe to overlook one! Certain forms formerly supposed to be exclusively saprophytes, living only on dead tissue, have been found, under certain circumstances to be actively parasitic. This is true of even such a common saprophyte as *Polyporus hirsutus* Pers. *Trametes badia* Bk. may be purely saprophytic, but I found it in the Botanic Gardens, Singapore, on *Saraca declinata* with its mycelium penetrating living tissue. The life histories of every fungus appearing on Hevea—living or dead, should be clearly traced. From every fungus producing spores on dead tissue, inoculations should be made into living tissue, and in many cases they will be found to take hold with definite parasitic action. If *all* were included I have no doubt that the identity of various obscure fungus diseases would be determined by this indirect method, where other methods had failed. I also have no doubt but that it would bring to light

a number of parasitic diseases not yet known to planter or plant pathologist: and this is where we would like only too well to begin our knowledge of all plant diseases.

During a recent short term of service at the Botanic Gardens, Singapore, in the heart of the oriental rubber region, I began a simple census of the fungi to be found, in fruiting forms, on Hevea. The cutting short of my stay stopped the work almost as it was begun; but the meagre results obtained have been most astounding and indicate the almost complete former neglect of this subject in a country where it should have been receiving, long since, the most intensive attention. Out of the first fourteen fungi encountered, other than Basidiomycetes, *ten were forms wholly new to science and one represented a distinct new genus!* These have been determined by Saccardo, the dean of living mycologists, (in Bull. Orto Botan. R. Univ. di Napoli, VI, (1918), 40-65), as follows:—

On dying leaves.
Sphærella heveana Sacc. sp. nov.

On dead limbs.
Didymella oligospora Sacc. sp. nov.
Neotrotteria pulchella Sacc. gen. and sp. nov.
Eutypa ludibunda Sacc. v. *heveana* Sacc. var. nov.
Cryptovalsa microspora Sacc. sp. nov.
Peroneutypa heteracanthoides Sacc. sp. nov.
Nummularia repandoides Fuch. var. *singaporensis* Sacc. var. nov.
Daldinia concentrica (Bull.) Ces. v. *escholzii* (Ehrenb.)
Lembosia glonioidea Sacc. sp. nov.
Hysterium heveanum Sacc. sp. nov.

On rotting stumps.
Xylaria (Xyloglossa) tuberiformis Berk.
Xylaria (Xyloglossa) obovata Berk.
Xylaria (Xyloglossa) scopiformis Mont. v. *heveana* Sacc. var. nov.

On rotting trunks.
Pleonectria heveana Sacc. sp. nov.

Of course it is probable that some of these are purely saprophytic, though no one *knows* anything about this. It will be recognized that a number of the genera are well known to include active and most serious parasites. On the other hand both saprophytes and parasites may be represented in one fungus genus: and usually nothing final can be said without careful investigation, since, as I have already stated, fruiting forms in dead or even rotting wood may originate from mycelia actively parasitic in living tissue.

The same spirit of inquiry should be directed toward all of the Basidiomycetes growing on Hevea. In the short time at my disposal I encountered the following on Hevea in Singapore:*

* All determined by N. Patouillard, Neuilly-sur-Marne (Seine), France.

On dead limbs.

Favolus spathulatus (Jungh.)
Hexagona cervino-plumbea Jungh.
Hexagona pulchella Lev.
Hexagona thwaitesii Berk.
Lentinus leucochrous Lev.
Lopharia mirabilis (Bk.) Pat.
Polyporus flavus Jungh.
Polyporus grammocephalus Bk.
Trametes lachnea Berk.
Trametes persoonii Mtg. forma resupinata.

On rotting stumps.

Polyporus hirsutus Pers.
Polyporus rugulosus Jungh.
Polyporus williamsii Merr.
Trametes persoonii Mtg.

It seems certain that in view of all the facts, even more rigid sanitation should be required in rubber plantations than among coconuts,—where sanitation is an effective protection against some of the most destructive pests and diseases. In a large and otherwise well managed rubber plantation on Singapore Island, where a considerable amount of thinning had been done some time before my visit, I found that the dead trunks and stumps had been left on the ground long enough to secure the development of vast numbers of fruiting bodies of a large series of fungi, thus insuring the thorough distribution through the plantation of billions of viable spores. To put the matter off by saying that most of the species are probably saprophytic is, I believe, in view of our almost entire lack of knowledge concerning them, merely "flying in the face of Fate." Our very lack of knowledge should be the soundest possible reason for the most rigidly perfect plantation sanitation! I have long been interested in fungi and have pursued the subject in many countries, but have been always hard pressed to find any time for extensive field work. Yet I have brought together extensive materials in some of the most interesting groups of the Ascomycetes, and this, too, in groups in which good spore bearing material is usually difficult to secure. Much of this has been accomplished by a method which is simplicity itself. In the forest the distribution of spores of a vast number of species is very wide, in fact, almost universal, by reason of wind and rain. Therefore I have only to cut a bundle of fagots of any known tree and expose it to normal forest conditions to secure most of the fungi naturally adapted to that special substratum, both saprophytic and parasitic. Some species fruit only on decorticated wood, some only on young twigs, others only on limbs of special sizes and degrees of maturity and still others only on trunks or leaves; and different seasons will produce different results on all these types of substrata when handled as above indicated. Finding this method of the greatest success in the forest, I began years ago to apply it in garden, field, and orchard, securing in this way very fine fruiting material of a

large number of fungi, many known to be of great economic importance. In view of all of these facts I believe that the plainest common sense will dictate the necessity of the most rigid sanitation in and near rubber plantations.

This is all a look forward. The few plant pathologists who have been privileged to work in the Peninsula have accomplished results of value which should be in no wise discounted. But the "field is so great and the hands so few" that there is no present promise of our being able to compete with nature in this matter. The natural state of the forest is not only one of superabundant life but also one of wholesale and all-pervading death. The successful upsetting of the normal plan of nature, and maintainance of health and vigor in every individual of an extensive plantation, can only come out of comprehensive, intensive, and adequately supported scientific investigation.

C. F. BAKER.

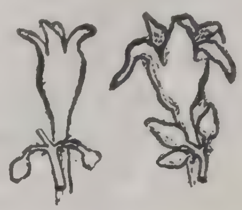
THE GARDENS' HEVEA TREE No. 1844,—H. CONFUSA, HEMSL.

Planted in the exact centre of a small rectangular bit of ground close to the office in the Economic Garden stood a rather small rubber tree which bore the number 1844. Its dark grey bark attracted attention to it; and when it was more closely examined the foliage was seen to differ from that of the neighbouring trees of *Hevea brasiliensis*. Its history was unrecorded: but by the way in which it stood, it suggested that it came by no accident, but was set in its position as something apart from the other rubber trees.

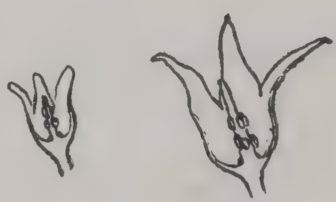
When it flowered in 1917 it was seen that the flowers removed it far from *H. brasiliensis*. The seeds also were found small, though not outside the extraordinarily wide limits in which *H. brasiliensis* varies: when it was tapped the latex was found to be yellow, meagre in amount and to remain tacky, with little elasticity. It appeared to be an undesirable type: but it was determined not to destroy it without enquiry. Flowering specimens were therefore dried and sent to the Royal Botanic Gardens, Kew, where Sir David Prain has been so good as to have it determined as *Hevea confusa*, Hemsl. The tree has now been destroyed on account of its proximity to the seed bearing trees, lest it should bring about cross-pollination; but seedlings have been raised in order that if any purpose is found for it, the species may be available.

Hevea confusa originates from British Guiana. It differs in so little from *H. pauciflora*, Muell. Arg., of the same region that to unite the two on botanical eye characters is quite justified; and if united, it takes the second name. Seeds of the tree 1844 had been sent to Dr. P. S. Cramer before flowers could be sent to Kew; and with no more material than this he had suggested *H. pauciflora*

as the species. It belongs to the section of the genus which has the male flower-buds blunt, as the annexed figure shows, whereas in *H. brasiliensis* they are acute. The female flowers of *H. confusa* are further a little smaller and the male flowers considerably smaller than in *H. brasiliensis*.* But a still more striking difference is in the pose of the male flowers.



On the left a female flower of *H. confusa* with buds of two male flowers (a third has been broken off). On the right a female flower of *H. brasiliensis* and three male buds. Note the smaller flowers of the first and that the male buds bend earthwards.



On the left a male flower of *H. confusa* in section and on the right a large one of *H. brasiliensis* which is very variable in regrad to size of its male flowers. Note the blunt perianth lobes of the first.

The panicle in *H. brasiliensis* carries up to 300 flowers of which, always if well developed, the terminal flower is female; and the better developed the more female flowers are there, terminating the stronger lower branches, up to about 7 in number. Thus a panicle that is weak may be wholly male, and the stronger and larger it is, the more in number are the female flowers on it. All these female flowers take their position as regards the earth from the axis that they terminate, and that position is generally in some measure such that they are directed upwards or obliquely upwards: but the divergence of this angle from the vertical is determined by the angle at which the branch takes off from its parent axis and again this by the angle at which the parent axis stands. The panicles produced by tree No. 1844—*H. confusa*—are narrower than those of *H. brasiliensis*, as much because the angle at which the side axes take off is smaller, as because, at least in tree 1844, they are of lesser size. The weakest panicles are wholly male as in *H. brasiliensis*, and the stronger carry more and more female flowers upon the lower side-branches up to 5 or 6.

* J. Huber, Novas contribuicoes para o genero Hevea in *Boletim do Museu Goeldi*, vii, 1910, pp. 200-216, has discussed at some length the size of the flower. as a character by which species and groups of species may be distinguished f om each other.

The perianth of the female flower in *H. brasiliensis* is of a dull mustard yellow, and if normal consists of five ovate acuminate sepals coherent in their lower third into a cup, which is of a greener tint inside than the lobes. This cup is almost filled by the ovary, around the base of which is a slight circular swelling being the disc which may be just damp with honey; five slight thickenings extend up the cup as the midribs of each part of it. In *H. confusa*, the perianth lobes are ovate and blunt, and the cup extends to half their length; they and the cup are straw-coloured with a magenta line down the middle from the tip or near it to the very base inside. Outside they are covered with short hair. The top of the ovary is conspicuously blunt with sessile stigmas.

Often in *H. brasiliensis* the first flower of a panicle to open is a male flower; but after all the female flowers are over, there are males that follow in considerable numbers. The male of *H. brasiliensis* is like the female in perianth, but smaller and hardly pale green within the cup. The staminal column carries two rings of five anthers. The pose of the flower depends upon the axis which bears it, and it may face in any direction. The male flowers of *H. confusa,* like its female flowers, are smaller than those of *H. brasiliensis,* blunter, different in colour, being straw-coloured: they have fewer anthers, and by the bending of their pedicels they face more or less earthwards. Outside they are hairy. This bending of the pedicels gives a very good distinguishing mark which the herbarium student cannot note so well as the field student.

The seeds are as figured by Hemsley in *Hooker's Icones Plantarum,* plate 2575: but tree No. 1844 gave flowers with blunter perianth-lobes than the figures on plate 2574.

Hevea pauciflora is known to produce hybrids with *H. brasiliensis,* and so far it seems that these hybrids have no value.

A sample of rubber from the tree was submitted to Dr. Frankland Dent, Government Analyst, Straits Settlements, and another to the Director of Agriculture, F. M. S., for kind submission to Mr. B. J. Eaton, Agricultural Chemist in the Department of Agriculture. These two samples on analysis scarcely differed: they contained about 95 per cent of a substance chemically rubber but lacking the physical properties required in commercial rubber, probably as Mr. Eaton suggested a polymer of caoutchouc; and they contained also rather under 2 per cent of resins. The samples were too small for a vulcanization test. They were small because the tree yielded so grudgingly.

I. H. Burkill.

MANGO PESTS IN SINGAPORE.

In no other part of the tropics are mangoes more badly pest-ridden than in Singapore. Locally produced fruit is therefore neither abundant nor of good quality. There is nothing in Singapore to compare with the great quantities of fine "carabao" man-

goes produced in the Philippines. It would be a catastrophe immeasurable if the mango pests of Singapore were introduced into the Philippines.

Among the mango pests of Singapore, three are very conspicuous, one insect—a psyllid,—and two fungi. The psyllid produces a leaf gall the size of a small pea, and these are sometimes so numerous as to occupy a large part of the surface of the leaf. When the insect is mature, the gall splits open at the top, the acute segments recurving. These insects secrete considerable quantities of honey-dew, and this may account for the astonishing growths on the same and neighbouring leaves of a sooty black fungus, *Meliola mangiferae* Earle. This fungus was described from Porto Rico but has been found to be practically pantropical in distribution. Between the psyllid and the fungus, the leaf has little chance of performing its natural function.

Certain trees which have escaped the psyllid and the *Meliola* may have practically every leaf scattered thickly with the small reddish brown nodules of an extremely serious fungus pest, *Zimmermanniella trispora* P. Henn., and under this load the leaf soon dies and falls.

The investigation of these pests should proceed from two points, first beginning with the psyllid, and second to determine the degree of parasitism in the *Zimmermanniella*. It is entirely probable that remedies can be devised to control these and keep the trees clean and healthy.

C. F. Baker.

FUNGI FROM SINGAPORE AND ALSO FROM PENANG.

"Fungi Singaporenses Bakeriani."

[The following enumeration is of fungi, collected with two exceptions, by Professor C. F. Baker during his short service with the Government of the Straits Settlements: and enumerated by Prof. Saccardo in the Bulletino del Orto Botanico Reale di Napoli, Vol. VI, (1918) at the pages given after each name. In the Journal of the Royal Asiatic Society, Straits Branch, No. 78, 1918, pp. 67-72, will be found descriptions of sixteen others under the title of *Some Singapore Boletinae*—a joint paper by M. N. Patouillard and Prof. C. F. Baker: and again in the Bulletin de la Société Mycologique de France XXXIV, 2e fasc. is described by M. Patouillard a further fungus *Echinodia Theobromae* from dead Cacao branches in Singapore.] Ed.

Puccinia clavispora Ell. and Barth. Singapore Gardens, on *Andropogon nardus* v. *citronella* .. .. p. 40

Aecidium balansæ Cornu. Penang, Government Hill, on *Agathis alba* (Burkill) .. .. p. 40

Aecidium cassiæ Bres. Singapore, Tanjong Pagar, on *Cassia tora* (Burkill) .. .. p. 40

(89 species and varieties, 67 *new*.)

ACCLIMATISATION TRIALS OF LIMA BEANS

(Phaseolus lunatus).

The following varieties of Lima beans were received from Philadelphia U. S. A. on 23rd July, 1918:

No. 1. Siebert's Early.
,, 2. Purple improved bush.
,, 3. Small Lima or Sieva pole.
,, 4. Dreer's Wonder bush.
,, 5. Fordham's bush.
,, 6. King of the Garden.
,, 7. Dreer's improved pole.
,, 8. Henderson's bush.

On 31st July, 8 beds, 18 feet by 3½ feet numbered 1 to 8, and labelled, were, after a preliminary liming, sown with 28 seeds of each variety, one for each bed. The soil had been previously manured and had given a crop of maize.

Bed No. 2 showed no sign of germination, a second sowing, and a trial in pots gave a like result.

Bed No. 7 gave only 6 germinations with shrivelled leaves of no vitality. A second sowing gave nothing. The two beds were dug up.

During August and September, the remaining six beds were kept weeded, and stirred, each plant receiving a light earthing up.

In the records kept, the growth of the beds is set down as follows:

No. 1. Siebert's Early.

30th September. "The plants have come up very strong—a strong climber, with heavy foliage and a fair show of flowers. A sparse crop of broad pods 3½ to 4 inches long, with a kink at the tip—with two or three beans per pod, which, I fear, will not develop to full-size seed."

15th October. (76 days from sowing), four mature pods were plucked, but only two beans were found fit for seed.

No. 3. Small Lima or Sieva Pole.

30th September. A thriving plant; a strong and healthy climber, by far the best of all the Limas. Very heavy foliage with abundance of small pods 2 to 3 inches long, ½ inch broad. Not attacked by white fungus, which is prevalent on neighbouring beds. In this case, as in No. 1, the foliage was so dense that it had to be thinned down, and the stakes had to be braced to support the weight. The excessive flowering had also to be checked by pinching back the tops—which also tends to strengthen growth below.

No. 4. Dreer's Wonder Bush.

30th September. As its name implies, does not climb. Only a few beans are showing: they are very broad (one inch) with a pronounced kink at the tip. Spots of rust are noticeable on many pods.

No. 5. Fordham's Bush.

30th September. Abundant flowering, but no pods formed as yet.

No. 6. King of the Garden.

30th September. A climber, but a weak and unhealthy-looking plant. A very few pods are visible of the very broad kind, 4 inches long.

15 October. This bed is now showing a fair number of pods some of which measure 5 inches in length: but many are flat containing no seed, or abortive seed.

No. 8. Henderson's Bush.

A squat, leafy bush with a number of small pods, eight on the average, to each bush: the pods, 2 to 3 inches long, contain mostly 3 seeds. It seems to resist the white fungus which has killed many plants on beds Nos. 5 and 6. This bean is, after No. 3 Small Lima or Sieva Pole, the most promising of the Limas. Yet a second bed, sown on 16th September on a previous ground-nut plot, had failed.

As mentioned, a fungus, taking the form of a white hoar-frost, particularly visible in the early mornings, or after rain, along the lower parts of the stems, had attacked the vines in all the beds except numbers 1, 3 and 8: its effect was deadly on the plants attacked, which gradually dried up and decayed.

All the Limas, except Nos. 1, 3 and 8 were therefore dug up and eliminated from this trial.

The progress of these 3 beds is recorded at length in the Journal; but in order not to unduly extend these notes, No. 1 Siebert's Early may be at once eliminated as a failure, for although it is still growing in the garden, it seeds sparsely and the pods are badly filled.

No. 3. Small Lima or Sieva Pole.

A remarkably prolific vine, without, so far, trace of rust, or of the fungus which has attacked the other beds, and which, after microscopic examination, was identified by Mr. Deshmukh as *Colletotrichum lindemuthianum.*

October 9th. (70 days from date of sowing) plucked a few pods, which gave 16 fairly large, flattish beans which were, soon after, planted on a separate bed.

October 10th. The foliage is so thick that it has to be thinned for the second time, to allow at least a partial access of the sun to the pods.

October 14th, 75 days from date of sowing, collected 70 pods which gave 151 beans, of which 110 were selected for seed.

October 15th to 23rd, the following crop was gathered in daily pickings:

546 pods yielding 1187 beans, of which 814 were selected for seed.

October 24th to 9th November, the following crop was gathered. 255 pods yielding 583 beans, of which 309 were kept for seed.

After 9th November, a large number of pods were picked, but many were found to be empty, or with abortive seeds, or in some cases, germination had already started within the pods. The fungus referred to above had now attacked this bed also, and none of the beans, from that date, were kept for seed.

So far, then, from 14th October when cropping began, to 9th November (*i.e.* from 75 to 101 days from date of sowing) the nett result of the crop was:

871 pods yielding 1921 beans of which 1233 (*i.e.* 64%) were kept for seed. This was obtained from 28 seeds sown at the origin, on the 31st July, 1918, and corresponds to a yield of 31 pods and 68 beans for every seed sown.

November 15th. There are still a number of pods on the plants but they are all, more or less, badly infested with maggots, and very few are fit, even, to eat. The bed is to be dug up. (The bed was not dug up as explained below).

It may here be mentioned that the shells of the Lima bean are quite uneatable, but the bean itself affords a quite excellent dish.

The Lima is, I believe, not much thought of in Europe. Decaisne does not recommend it: but it is held in high estimation in America.

If personal taste may find expression here, the writer's opinion is that the bean is equal to the best French Soissons: it is farinaceous and melting in the mouth—and, in every way, most palateable.

Second Generation.

Of the 1233 beans originally selected for seed, 556 had been sown in 15 beds on the 24th October, 1918; but there were many failures, and, on examining the remainder of the selected seeds, the reason of these failures was revealed. It was found that, by keeping, many of the beans selected as perfect for seed, developed defects, which were not, at first, apparent in the fresh beans. Small specks would appear under the skin of the beans, generally on or near the rim, sometimes also round the eyes, which specks very soon developed into a cancerous growth right through the whole substance of the beans; and, a few days after the sowing of such beans, it was found that, on opening, the two cotyledons were eaten through and through with rot.

This showed the necessity of keeping the beans for sometime before sowing, to give time for the disease to reveal itself, and, henceforth, all the beans underwent at least ten days' drying, during which a second and a third selection was gone through. The drying of the beans must take place in the shade, for the skin of the Lima is not thick, and if put out in the hot sun, the skins are apt to crack.

The failures of the previous sowing were made good, to their original number, namely 556, but of these a good 15 per cent was destroyed, partly by minute larvae, *Melolonthids*, introduced into the soil by immature cowdung, partly by night insects which nip the stems clean off.

The crop, as recorded, day by day, in the Journal, was therefore obtained from about 470 beans of the second generation.

The pickings, begun on 6th January, 1919 were stopped on the 31st March and the result to-date (12th April) is as follows:—

Number of pods picked ..	11174		oz.
Perfect beans selected for seed	9294	weighing	$269\frac{3}{4}$
Imperfect beans but eatable ..	5228	„	$77\frac{1}{4}$
Uneatable, diseased, maggotty, etc.	..	..	$38\frac{1}{2}$

470 plants have therefore given, so far:

11174 pods containing 14522 beans weighing 347 oz. or 24 pods and 30 beans for each seed put in the ground. As the crop is only half way through, no final figures can be given at present. Pending the early resumption of plucking, the beds are receiving a light hoeing and a mulch of fallen leaves, and prunings of the dead stems.

Before passing on to the record of the new crop *i.e.* that of the third generation now begun, it should be here mentioned that, under local conditions, the Lima bean becomes perennial, that is to say growth is continuous and, on the same plant, may be seen, at the same time, mature and immature pods, and flowers.

In Burmah, where the Lima bean is cultivated as a field crop, the same perennial habit of the plant has been observed by Mr. van Buren (Tropical Agriculturist, June, 1918).

The original bed, sown on 31st July, 1918, which, as previously stated, it was decided to dig up (but which for some reason was not dug up) is still giving crop, and at date of writing, new racemes of flowers are opening (255 days from date of planting).

At first thought, this continuity of growth would appear to be an advantage. The writer himself took it to be so, and seeing the bed put forth new flowers, it was manured and, in due course, new crops of beans came on. But it is a question whether it is not the more profitable course, after the main crops have been taken, to root up the plants, and put the beds to some other cultivation which will get the benefit of the improved soil brought about by the bean cultivation; or again, if the crop is to be beans, whether it is not the better course to dig up the old vines, enfeebled by previous crops, and replant with fresh seed.

In both cases, a thorough tillage of the soil will be necessary, with an application of manure, and there will be no saving on that head, while the crops of the new planting will, I believe, be much greater than if the old plants are allowed to "carry on" as perennials.

There are moreover, other reasons which tend to militate against perennial cultivation of the Lima bean.

The Lima bean has the well deserved reputation of being a very robust plant, branching profusely, and carrying a very dense foliage. If left to grow as a perennial, the beds form a tangle of stems, of branches and leaves, old and new, which it is almost impossible to keep in trim, and if any insect pest or fungoid disease descends on the beds, it is very difficult to cope with. Should moreover, the weather be very wet, which was the case here, these pests take such a hold on the old plants, that on a field scale, many would be killed. It was possible, dealing with only one bed, to keep the disease, anthracnose, in check, but even then, it was only by dint of frequent sprayings that the crop could be saved, and that only partially.

Another effect of the prolonged stay of the plants in the ground, is that, unless the poles, on which the vines are trained, are of wood which resists the wet, they are liable to rot and break down after some months, and it is no easy matter to prop up again in anything like order, the resulting medley of broken sticks and tangled stems.

This last remark does not apply to the case of field cultivation as practiced in Burma where the plants are not grown on poles but left to trail on the ground.

Lastly, the crops fall off, on the old beds, and they are not equal to those obtained from newly planted beds.

Third Generation.

From selected seeds of the second generation accounted for in the preceding pages, which seeds were submitted to further selection after trial in pots, 15 beds were planted with 455 seeds. The planting, begun on 11th January, was finished on the 25th of the same month 1919. It was limited by want of suitable land.

Crops Obtained from 3rd Generation.

1st to 5th April	548	pods gave	968	perfect beans	weighing	22 oz.
7th to 9th	,, 958	,,	2114	,,	,,	48½ oz.
11th	,, 1173	,,	2740	,,	,,	67 oz.
Totals to date	2679	,,	5822	,,	,,	137½ oz.

These figures show, at a glance, a marked improvement on the previous crop and this is brought strongly in evidence if the results of the two crops are put side by side: the figures stand as follows:—

Number of pods.	Perfect beans Weight.	Imperfect beans Weight.	Uneatable Weight.
2nd Generation 11174	4294—269¾ oz.	5228—77¼ oz.	28½ oz.
3rd Generation 2679	5822—137½ oz.	None.	2¾ oz.

In the first crop, each pod contained only 1.3 of beans, whereas in the second crop each pod contains 2.1 beans.

The first crop had 5228 imperfect beans; imperfect in appearance, in shape and colour, defects which, while not rendering them uneatable, would certainly detract of their marketable value. The second crop, although it was examined with greater closeness than the previous one, had not one such bean.

Of beans uneatable, maggotty, etc., the first crop had 38½ ounces for a total weight of 337 ounces or 11 per cent. the second crop had 2.36 for a total weight of 137½ oz. or 1.70 per cent.

Again, if we compare the weights of the two crops we find:

2nd Generation	14522 beans	weighing	337 oz.	or 2.32%	beans.
3rd ,,	5822	,,	137½ oz.	,, 2.36%	,,

The greatly improved quality of the beans of the latter generation is attributable to better weather conditions, secondly to absence, so far, of fungoid disease, and thirdly to more severe selection of the seeds which, one by one, underwent three sortings before sowing.

The Mature Bean.

The pod of the Lima bean, when approaching maturity, is, at first, of a bright yellow colour, which turns in one day or at the most in two, to a true khaki colour; at this stage, the beans are loose from the shell and, on shaking the pod, are heard to rattle inside. Then, is the time to pick them: if picking is delayed, dehiscence takes place and the beans may fall to the ground. The pods which, at maturity, are not of a true khaki colour, but which show streaks of brown or purple, or which are mottled green and brown, have almost invariably damaged beans, the stains being due to the decomposed state of the beans brought about by maggots or to the cancerous condition induced by *Colletotrichum lindemuthianum.*

The beans selected for seed should be pure white—opaque—not glossy but "mat" to use the French term. Any beans which, after keeping for a week, show a shrivelled skin or any discoloration whatever, or which take a semi-transparent hue, should be discarded: but such beans may be perfectly good to eat.

The beans selected for seed should be firm to the feel, and hard under the nail.

The diversity and irregularity of shape, and of size of the Lima beans has perhaps contributed, as much as anything else, to prevent their more general acceptance in Europe, for this uneven ness necessitates a rather troublesome sorting before marketing. For that reason, some care should be given to this matter of shape in the selection of the beans for seed, with a view to attain a type of true kidney-shape. The two predominating contours, I find, are the boomerang-shape, (but full on the inside) with a rather sharp apex—and the kidney-shape of the ordinary garden bean, but with the inside curve less pronounced.

The boomerang-shaped bean is almost always flat and large; the kidney-shaped is less large but it is rounder, plumper, fuller.

For that reason, given two beans of sound quality and of about the same weight, one of the boomerang-shape, the other of the kidney-shape, the writer would choose in preference, for sowing purposes, the latter one, even if somewhat smaller in size. Time will show whether the type breeds true.

The importance of a severe selection of seeds is very soon realised by planting this bean. From 60 per cent of germinations obtained in previous sowings, the latest sowings in the gardens commonly show from 90 per cent and upward of germinations.

Another very common feature in Lima beans are the striations converging from the rim to the hilum (eye).

These striations, much more marked on some beans than on others, are due to a tendency to reversion to the original red or purple coloured type. Seeds showing that character in a marked degree should be rejected for planting purposes, the purple coloured type containing, it is said, prussic acid.

If the beans are not destined to be planted, but merely for table use, their character may differ, in some cases, very widely, from the description just given. In the first place, the pods should be picked when they are of a light yellow colour, without waiting for the shell to turn to khaki colour. The beans themselves, instead of dead white, may be glossy, and the converging striations do not matter. Lastly, the shape is also of secondary importance although it affects the market value to some extent.

The Bulletin of the Imperial Institute (Vol. 15, No. 4) contains interesting reading on the subject of the Lima Bean or "Rangoon white bean." The following figures speak for themselves:

"Forms of *Phaseolus lunatus* are largely grown in Burma. "The two most common forms grown in Burma are the red-seeded "and the white-seeded kinds."

"In Burma, *Phaseolus lunatus,* is a favourite crop for field "cultivation, 240,000 acres being devoted to the white variety, "and 94,000 acres to the red variety in 1916-1917."

"The quantities and values of pulse, including peas, exported "overseas from the Province during 1916-1917 were: 1,439,000 "cwt. value £791,208."

"Of these quantities, 1,138,000 cwt. were exported to the "United Kingdom."

The large shipments to Peninsular India are not included in the above.

"Seeds are usually dropped into furrows in rows about 1 "to 1½ ft. apart: they are also sometimes broad-casted, mixed "with maize, and are covered with soil by harrowing. When sown "with maize, the stems of the maize plants serve as supports to "the trailing stems of the beans, but when sown alone, the stems "are allowed to trail over the ground. The crop generally takes "five months to mature."

The writer has tried experimentally the planting of Lima beans with maize; but the result was somewhat disastrous, both

the maize and the beans giving returns much below the average; but the chief objection to this mixed planting is that, in twining themselves round the maize stems, the bean stems strangle the maize cobs and arrest their development.

In other respects, also, the practice followed by the writer differed widely from the above.

First of all, the seeds were not sown broad-cast or dropped in furrows, but each bean was sown separately, the most advantageous distances being found to be 20 inches on rows one foot apart with 3 such rows per bed.

Secondly, the plants were not left to trail on the ground but were supported by poles, 4 poles for each 12 plants with transverse sticks on top. Planted on such lines as are here indicated, one acre of land affords room for 250 beds 30 feet long by 3½ feet wide with alleyways, each bed accommodating 45 plants in 3 rows of 15, at the distances specified above. Thus, one acre would accommodate about 11,000 plants, of which 10,000, under favourable conditions (well selected seeds and careful watching for pests) could be expected to reach maturity in three months, and to yield an average of two ounces of beans per plant, resulting in a crop of 1,250 pounds of beans.

It is impossible to draw up an estimate of the cost of a crop of beans to fit all conditions. But, given agricultural land under normal conditions, cleared of jungle and stumps, a land, say, of light secondary growth, which can be cleared and drained at small cost; a land, which can be got ready for the plow, or the changkol at a cost, say, of $20 per acre—then the expenditure could be figured as follows, for one acre:

Clearing and draining	$20.00
Labour; changkoling, raking and earthing up 1½ coolies for 3 months at $15	67.50
Seed beans, 16 pounds (selected) at $0.40	6.40
4,000 stakes at ½ cent	20.00
Fungicides and insecticides	10.00
Tools and appliances	8.00
Superintendence	5.00
Estimated expenditure	$136.90

If the plow is used instead of the changkol, the labour bill would be reduced by about $18.

The subsequent crops would cost less by about $50 but, if the soil is a poor one, manuring would have to be done at a cost of $25 to $30.

The planter would have the option, also, of leaving his crop on as a perennial, or of digging up and re-planting.

Good lallang land might very profitably be put under a bean crop, for it should be observed that by its heavy foliage, the bean supplies a dense cover and, during the 3 months which the crop demands, the lallang will be kept under.

Referring again to the above extract from the Bulletin of the Imperial Institute, it is there stated that the bean crop in Burma takes 5 months to mature.

As a matter of fact, with three successive crops, the writer has found that the crops mature in between 75 to 85 days and the pickings are heaviest between 90 and 100 days.

This is attributable, in the writer's opinion, to the fact that the plants were grown on stakes and not left to trail on the ground, as is the case in Burma. The beans grown on stakes are more open to the action of the air and sun, and the maturing of the pods is therefore much more rapid.

The results amply justify the extra expense of buying and putting up the stakes and, moreover, the beds are better accessible and, in case of outbreak of disease it is much easier to watch and to keep in check. The stakes themselves serve, to a certain extent, to guard the crop against fungus and insects by a smearing of them with strong Bordeaux mixture made adhesive by the addition of treacle, or sago.

Before closing these notes the writer would call attention to the fact that as shown by the crop records given above, three crops were obtained from the 31st July, 1918 to the 12th April, (date of writing) and that the fourth crop now partly planted or being planted, should, if all goes as in the past, be ready for harvesting by the 12th of July *i.e.* four crops in less than one year from the planting of the first crop.

Conclusions.

Whether due to absence of fungus, or to more severe selection of the seed used, or to better weather conditions, the improved quality of the Lima bean at present being harvested is manifest, and it bears proof that the bean has not suffered degeneration through change of climate and of habitat, and it may now be considered as definitely acclimatised.

E. Mathieu.

A PROGRESS REPORT ON THE CULTIVATION OF THE GREATER YAM, DIOSCOREA ALATA—IN THE BOTANIC GARDENS, SINGAPORE.

When reporting upon the cultivation of the Greater Yam in the Botanic Gardens, Singapore, in 1917, attention was called to the circumstance that the plants had been grown spaced 3 by 2 feet, and that in competition between each other at such a distance they had produced smaller tubers than in the earlier years. But space forbad again in 1918 that the distances between them should be increased, and consequently the yields of 1816, for instance, were not attained. Moreover there was not available quite so much manure; and the want of it has also had an effect. The 1918 crop was consequently less abundant than the crops of 1916 and 1917.

The number of races grown together on the ground was 93. The average yield was 3.77 lbs. (1712 grammes) per hill. In the following table the three years are compared:—

DIOSCOREA ALATA, THE GREATER YAM, RACES NOT REQUIRING EARTHING UP.

Year	1916.	1917.	1918.
No. of hills ...	582	520	299
Area occupied ...	11,330 sq. feet	3,120 sq. feet	1,794 sq. ft.
being			
an area ...	.260	.072	.041
of a hectaire ...	.105	.029	.017
Number of sets			
which grew ...	.559	424	273
which failed ...	23	84	26
Return	1,810,076 grs. 3,969 lbs.	961,117 grs. 2,118 lbs.	467,214 grs. 1,030 lbs.
Yield			
per acre ...	6.89 tons	13.16 tons	11.21 tons
per hectaire ...	17.239 kilos	33,142 kilos	27,489 kilos
Average yield per hill			
i. e. failures included	3.110 grammes 6.83 lbs.	1,849 grs. 4,07 lbs.	1,563 grs. 3.44 lbs.
Average yield per plant			
which grew	3,238 grammes 7.14 lbs.	2,267 grs. 4,99 lbs.	1,712 grs. 3.77 lbs.

It is considered that the time has come to discard a large number of the races which have been grown. It is scarcely necessary to give any account of them, for it would serve no useful purpose to do so: they are no longer of much interest. But it will be useful to record the reasons why others have been kept; and this will be done next.

Thirteen races have for the past three years of careful competitive trials, year by year, yielded more than the average. Eleven of these thirteen have been kept, the race No. 132 being discarded as too similar to the race 76 to be required, and the race 140 as too near to the race 128. The eleven retained are:—

Gardens No.	Origin.	Name under which received.	Figured.
22	Philippines.	Ubi, white, No. 1031	G.B.II No. 2 pl.i.
44	do.	Ubi, red, No. 1025	do. pl. ii
50	do.	White Bohol	Philip Agric. III p. 207, fig. 17
52	do.	———	———
64	do.	No. 1040	———
66	do.	Ubi, white, No. 1046	———
76	do.	Sinanto	G.B.I No. 11-12, pl 2, and II No. 2 pl. i an
100	Saigon	Khoai noc trang	———
128	Sylhet, India	No. 35630	———
170	Port Darwin, N. Australia	———	G.B.I. Nos. 11-12 pl. iv.
192	Gold Coast.	Eururuka nkakyi	G.B. II. No. 2 pl,i

These differ greatly among themselves, for instance:—

Magenta sap at all depths in races	Nos. 100, 128.
„ under the skin only	Nos. 22, 44, 140, 170, 192.
„ not present ..	Nos. 50, 52, 64, 66, 76.
Tubers branched distinctly in races	Nos. 44, 100, 170.
„ lobed rather than branched	Nos. 22, 50, 52, 64, 66, 192.
„ neither lobed nor branched	Nos. 76, 128.
„ flattened in races	Nos. 22, 44, 50, 52, 64, 66, 100, 170.
„ not flattened	Nos. 76, 128, 192.

It may be noted that the races with flattened tubers which yield heavily, are in all cases either lobed or branched:

And again it may be noted that none of the long deep going yams are among these races.

In foliage the above eleven varied greatly. No. 76 has a prickly stem.

No. 50 is a yam that has been cultivated for three seasons in the garden of Mr. G. P. Owen, in Singapore; and in the first of them he obtained a tuber weighing 26 lbs. He gave sets from it to Mr. W. E. Hooper who obtained a still larger tuber with a girth of 52 inches and also to Dr. W. F. Samuels who at Tanjong Rambutan, Perak, also got large tubers.

It is believed that the following promise a yield of more than the average, but did not give it because of some mischance: therefore they have been retained as if heavy yielders along with those enumerated above. The mischance is the case of No. 102 was due to the necessity of interrupting the growth of the tubers, in the first season of trial before their time was complete, in order to bring them into the same period of growth as the others; and in the case of No. 10 the mischance arose from thefts: in the case of all the other, the start in 1916 was with undersized sets.

Gardens No.	Origin.	Name under which received.	Figured.
10	Philippines	Tugui, finger shaped No. 1057	G.B. I. No. 9 fig. 2 on p. 299.
48	do.	No. 2712	—
60	do.	Kinampay ubi	—
102	Saigon	Khoai mo.	—
166	Fiji	No. 20705	—

The relation of these to the average (as 100) in the successive years was:

No.	1916.	1917.	1918.
10	183.23	97.13	22.14
48	57.78	84.61	125.00
60	60.41	88.97	165.36
102	39.41	69.17	158.12
166	14.89	80.90	104.21

These five, like the eleven proved heavy yielders enumerated above, vary greatly among themselves. Two have magenta sap at all depths (Nos. 10 and 60), two have it under the skin only (Nos. 102 and 166); while No. 48 is without it. One of them (No. 60) is branched, the others being for the most part neither branched nor lobed.

So far, then, the total number of races, out of the 93 grown in 1918, which have been retained for further cultivation, upon their yield, is sixteen. Selection beyond this has been done upon other characters. In the first place it has been deemed well to keep a few of the very deep going races, because they appear to be among the most excellent for the table; it seems that the cultivators find the compensation for the labour of digging them, in the eating of them. Six have been retained, being:—

Gardens No.	Origin.	Name under receiv-ed which.	Figured.
30	Philippines	Ubag No. 960	G.B. I fig. 12 on p. 301
54	do.	No. 1044	———
68	do.	No. 1692	G.B. I Nos. 11-12 plate ii
108	Fiji	No. 20693	———
118	do.	No. 20710	G. B. vol. I Nos. 11-12 Plate i
186	Assam, India	No. 35575	do.

Nos. 30 and 68 give tubers among the longest which have been cultivated: both appear to be very good table yams, and both have a tendency to produce twin tubers. Nos. 108 and 118 give tubers somewhat more clavate, No. 118 having magenta sap, but not so No. 108. No. 118 is certainly a good table yam. Both, and also No. 54 have very delicate skins, which bruise easily. The shape of the tuber of No. 54 is clumsy and so also is that of No. 186: and both have been retained with some hesitation.

It is well known that, for instance, there is no sale in many markets for oversized lemons. So too many markets take up small neat yams better than large yams: and with the intention of trying to meet such a case it had seemed well to retain two races of the Greater Yam which are noteworthy for the smallness, and neatness of their tubers. They are:—

Gardens No.	Origin.	Name under which received.	Figured.
6	Singapore	Ubi merah	G.B. I No. 11-12 plate iii
70	Careline islands	No. 3793	do. plate ii

They are very unlike each other, and indeed have nothing in common except shape. The ubi merah is well established in the Malay Peninsula, and can easily be got in the Singapore markets. Chinamen grow it about Klang: and it has been seen on sale as far away as Rangoon, near which assuredly it is cultivated. It has an extremely delicate skin which is always bruised before it reaches the market and then the intensely coloured sap below it is very noticeable. Possibly the delicacy of its surface accounts for the circumstance that in 1916 it was badly attacked by white ants in the yam beds in the Botanic Gardens. So far the impression is that it is not a really good table yam.

No. 70 on the other hand has a firm surface, and keeps well in store. It is altogether without magenta sap, and seems to be a good table yam. In foliage it is quite unlike No. 6.

Five lobulate yams have been kept in addition to the heavy yielding races of that class,—Nos. 22, 50, 52, 64, 66 and 192, also one branched yam in addition to the heavy yielding Nos. 44, 100 and 170. These six are, No. 98 being the branched yam:—

Gardens No	Origin.	Name under which received.	Figured.
40	Philippines	Ubi from La Union, No. 943	—
56	do.	Dinogo, No. 965	—
62	do.	Ubi long. No. 1023	—
78	do.	Ubi, No 938	G.B. II Nos. 2 plate iii
94	Guam	—	—
98	Saigon	Khoai Siam	G.B. I Nos. 11-12, plate iv.

Nos. 40 and 62 yielded more than the average in 1916 and 1917, but less than the average in 1918:

Nos. 78 and 98 yielded more than the average in 1916, but not afterwards. Because they seem to have good keeping qualities they have been retained for further cultivation, and especially to observe their behaviour comparatively in store. No. 56 also appears to have keeping qualities; but its yield has never yet exceeded the average yield. No. 94 has been kept for a little further study as the best in yield of the yams received from Guam island.

Finally as not yet studied adequately the following have been kept:—

Gardens No.	Origin.	Name under which received.	Figured none
350	S. Nigeria	Ewura	
366	Gold Coast	—	
368	do.	—	
388 †	Nigeria	Adjugo kwami	
390 †	do.	do.	
406	Philippines	Found mixed with No. 60	
408 †	Saigon	Selected from Khoai Siam No. 98 in 1917	
410	Philippines	Selected from No. 52 in 1917	
436 *	Papua	Makoda (*a*)	
438 *	do.	Makoda (*b*)	
440 *	do.	Moiva	
444	Klang, Selangor	—	
448	do.	—	

Those marked with an asterisk above are being grown apart from the rest, for it has not been possible to bring them into the same series with the main crop, as the season at which they were received and planted in no way corresponded with the seasons kept by the main crop. They are said to be from wild plants. Those marked with a dagger are also being grown apart, as for various reasons they were planted two months earlier than the main crop.

Upgrowing Yams. The races of the upgrowing yams are few; and five are being retained in cultivation. It is believed that the Gardens numbers 38 and 72 scarcely differ; and of them No. 72 is being kept. Both yield more than the Nos. 28, 32 and 34. Number 28 yields the least of all five; and it is transitional towards the branched yams of the normal type. Number 32 and 34 are very similar to each other, the second however yielding rather more than the former.

All upgrowing yams appear to be good table yams; and all have magenta sap in the tissues.

Gardens No.	Origin.	Name under which received.	Figured
28	Pilippines	Tumuktoh, No. 1095	G.B. I No. 9 fig. 1 on p 301 and Nos. 11-12 pl. V. & II on i pl. ii
32	do.	Tinugue, No. 956	G.B. I No. 9 fig. 3 on p. 301
34	do.	Ballolong, No. 943	G.B. I No. 9 fig. 4 on p. 301.
72	do,	Sinaway pulo, No. 955	G.B. I Nos. 11-12 pl. vi & II No. 2 pl. iv.

I. H. BURKILL.

IT NEEDS WANT TO MAKE PEOPLE CHANGE THEIR FOOD-HABITS.

It needs want to make people change their food-habits; so intensely conservative are we in such matters, with some reason, but also with all the prejudice that we can let play. The following paragraphs from the *Gardeners' Chronicle* of February 3rd, 1917, p. 53, on the passing away of a now forgotten prejudice against the potato, are quoted in illustration, and as being appropriate to the present time when the Malay Peninsula is faced with a shortage of rice which must compel a large part of the population to eat something unusual; and that they will resist doing. This is what is written in the *Gardeners' Chronicle.*

"Raleigh we are told at school, introduced the Potato from Carolina: but Raleigh never was in Carolina, nor does the Potato grow wild there, being a native of Peru where it was found by Pietro Cieza de Leon about 1532. This Spanish traveller followed Pizarro, whose conquest of Peru thus directly led to the introduction of the Potato into Europe.† Its welcome in Spain was not warm; for long it was but a curiosity; and it is said, with what truth we dare not say, that the Church frowned upon it seeing in it a competitor with the titheable wheat. In Italy its reception was hardly less cold; and as a food plant its spread on the Continent was everywhere slow.

Its introduction into Ireland is said by many writers to be due to Hawkins,* and if this be established, it seems probable that it was seized on one of his Spanish prizes. It soon became widely grown there, and thence spread to Lancashire, the first part of England to undertake its culture upon a large scale.

† The potato of Falstaff, it should be said, refers to a different plant altogether, a member of the Convolvulus family, whose edible tubers were grown and used when candied as a sweetmeat.

* John Hawkins, Elizabethan navigator, 1253—1595, born in the year of the discovery of the potato by Cieza de Leon.

In England it did not lack supporters, and in 1663† the Royal Society listened to a Mr. Buckland, who spoke long and warmly in its praises. How far this championship succeeded is doubtful. One witness tells us it was common in England in 1698, but a dozen contemporaries give him the lie." If I can't get bread, wrote Richardson in *Pamela* in the year 1740, I will live like a bird in winter upon hips and haws, and at other times upon pignuts and potatoes. The coupling of the potato with so mean a weed as the pignut ranks it very low, while admitting it among familiar country objects. "The general trend of evidence is that the Potato did not come into anything like general use until the distressful years that followed the victory of Waterloo.

Even then it did not lack detractors. Cobbett thundered against the "infamous vegetable" which with the use of tea would reduce the sturdy English labourer to the level of the Irish peasant. The Times in 1829 considered it as "a fit esculent to lower the food of the opulent" but its use among the working classes would lower them to "a nation of miserable turbulent drunkards." In France it was considered "le plus mauvais de tous les légumes dans l'opinion générale. Cependant le peuple qui est la partie la plus nombreuse de l'humanité s'en nourrit." This was written in 1779.

Parmentier,‡ whose name still figures on our menus when potato-soup requires disguising, succeeded in introducing it to higher circles, and even persuaded Louis XVI to wear its flower in his buttonhole.

In Scotland the dearth of 1740 led to its introduction, and here again it met with the usual opposition. "Tatties! tatties!" said one old native, "I ne'er supped on them a' my days, and and 170. These six are, No. 95 being the branched yam:—
winna the nicht." The more philosophical argued that potatoes were not mentioned in the Bible. However the tatties made themselves at home, and have kept many a scotchman from treading the broad road that leads to England.

Potatoes are now a habit." The potato plant has won through: and its cultivation has received not a little further stimulation in the calamity of the Great War. Its history preaches the fact that our food prejudices are enormous, and hard to break.

For some years an attempt has been made from the Botanic Gardens to popularise the use of tubers which are capable of being local substitutes for the potato, with scant success among those who can afford to have prejudices; but the repeated thefts from the crop show that the needy, who cannot afford to have many, will eat them. Unfortunately the needy being unable to propagate them, are merely destructive.

These tubers are certain yams, yautias, and what the French call crosnes,—all easy of digestion if properly cooked.

I. H. Burkill.

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† or close upon 100 years from its introduction into Ireland.

‡ Antoine Auguste Parmentier, 1737—1813.

HOW TO PREPARE MAIZE FOR BREAD OR PUDDING.

Amongst suggestions for the preparation of locally-grown food-stuffs in a circular issued by the Acting Director of Agriculture, Trinidad, the following is worth drawing attention to: "To prepare Indian corn to get best results for several kinds of bread or pudding, it is best to take off the skin. This is done as follows: To 2 lbs. corn allow 2 lbs. sifted ashes and about one gallon water, and boil for one hour. It is sufficiently boiled when a grain squeezed between the fingers pulps out of the skin. Place the pot from the fire under a stream of cold water, and rub the corn with the hands when the skin will easily separate, and the overflow of water will carry away all the ashes and the skin. When clean, drain off the water, add about 1½ gallon clean water, and reboil for about fifteen minutes. The grains must then be crushed into a fine paste, either in a mill or a meat mincer." (Trop. Agriculturist, Ceylon, March, 1919, lii, p. 125).

"PLANTS and SEEDS INWARDS"

of the Botanic Gardens, Singapore.

The following table has a small historic interest; it is of the number of entries year by year in the "Plants inwards" books of the Botanic Gardens; each entry being the name of a plant indicating a receipt,—it may have been in the form of seed or of a plant or plants alive. From the figures we find that Murton upon his coming ran up the number of importations to 673 to fall again, but to be raised to 863 in 1879 as the result of the exchanges for orchids which he established. Cantley in his second year imported 718 and in 1887—his last—1490; Mr. Ridley's receipts average about five hundred annually.

Years.										
1875—1880	—	—	—	—	166	673	197	250	863	89
1881—1890	336	718	477	297	449	689	1490	488	897	1127
1891—1900	498	503	777	630	305	383	404	449	487	336
1901—1910	195	429	436	629	552	545	441	576	832	587
1911—1918	522	621	734	424	407	964	840	1052	—	—

RAINFALL at the Director's house, Botanic Gardens, Singapore during the first half of the year 1918, in inches.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin

Date.	Jan.	Feb.	March.	April.	May.	June.
1	.01	nil.	nil.	nil.	2 08	nil.
2	.02	.09	nil.	nil.	.05	.01
3	.08	.03	nil.	1.78	nil.	nil.
4	.18	.02	nil.	.29	nil.	nil.
5	.49	.08	trace.	.66	.08	.84
6	.22	trace.	nil.	1.30	.01	.10
7	.27	.39	.21	.04	.05	1.71
8	.59	nil.	.03	1.47	1.05	.79
9	.48	trace.	.73	.05	.98	.13
10	4.62	nil.	.07	nil.	.18	.13
11	5.42	nil.	.23	nil.	.10	.07
12	6.07	nil.	.68	.09	.73	.53
13	.03	.09	.11	.02	.32	.01
14	.29	1.03	.06	1.44	nil.	.19
15	.77	.13	nil.	.02	nil.	.27
16	nil.	.12	nil.	nil.	.30	.02
17	.14	.08	nil.	.52	trace.	nil.
18	.12	nil.	nil.	nil.	.05	.24
19	.05	nil.	nil.	nil.	.20	.02
20	1.33	nil.	nil.	.02	.01	nil.
21	.80	nil	nil.	1.04	.59	2.02
22	.01	nil.	nil.	.03	.03	.08
23	.08	trace.	nil.	.45	1.19	trace.
24	.29	.01	nil.	trace.	.17	2.48
25	nil.	nil.	trace.	.90	nil.	.02
26	nil.	nil.	nil.	trace.	nil.	1.99
27	nil.	nil.	nil.	.15	nil.	nil.
28	nil.	nil.	nil.	.04	nil.	nil.
29	.01		nil.	.43	nil.	nil.
30	trace.		trace.	nil.	.02	.04
31	nil.		.04		.02	
	22.37	2.07	2.16	10.74	8.21	11.69

RAINFALL at the Director's house, Botanic Gardens Singapore during the second half of the year 1918, in inches.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.15	.01	.11	nil.	.06	1.88
2	.02	.01	nil.	nil.	.50	.02
3	.17	.11	nil.	nil.	.01	.18
4	.09	.03	trace.	nil.	.02	.02
5	nil.	nil.	.11	nil.	trace.	.02
6	nil.	nil.	trace.	nil.	.01	nil.
7	nil.	nil.	2.21	.02	nil.	.01
8	nil.	.23	2.18	.01	.76	2.18
9	.03	.04	.01	.01	.03	.01
10	.61	nil.	nil.	nil.	nil.	.03
11	.02	.46	.05	.46	nil.	.01
12	nil.	.07	.16	.01	.14	1.27
13	nil.	.02	trace.	nil.	.02	trace.
14	.02	nil.	.32	nil.	nil.	nil.
15	1.21	1.07	.02	.79	.70	1.14
16	nil.	.46	1.62	.06	.07	.29
17	nil.	nil.	.02	nil.	.08	nil.
18	nil.	nil.	1.30	trace.	nil	nil.
19	nil.	nil.	nil.	.38	.02	.04
20	.16	nil.	nil.	nil.	.20	nil.
21	.12	nil.	.15	nil.	1.23	nil.
22	nil.	nil.	.06	nil.	.01	.41
23	nil.	nil.	nil.	nil.	.07	.15
24	nil.	2.90	.34	.14	.02	nil.
25	.01	.01	.01	.02	.29	.13
26	nil.	nil.	nil.	.18	.04	.17
27	nil.	nil.	nil.	1.72	.31	.91
28	trace.	.35	.21	.02	.80	.03
29	.91	nil.	nil.	1.23	.39	.03
30	.67	nil.	nil.	1.33	.60	.19
31	.10	trace.		.01		nil.
	5 29	5.77	8.88	6.39	6.38	9.12

RAINFALL at the head of the Waterfall Gardens, Penang during the first half of the year 1918, in inches.

Reading taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Data kindly supplied by the Municipal Commissioners of George Town, Penang.

January.		February.		March.		April.		May.		June.	
Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
1	...	1	...	1	...	1	1.90	1	.10	1	1.36
2	...	2	...	2	1.41	2	.15	2	...	2	.04
3	...	3	...	3	...	3	...	3	.37	3	.87
4	...	4	...	4	...	4	1.80	4	.10	4	.19
5	.28	5	...	5	...	5	...	5	1.74	5	.20
6	.08	6	...	6	...	6	1.07	6	,03	6	2.18
7	·08	7	...	7	...	7	.16	7	...	7	.38
8	...	8	.12	8	...	8	...	8	...	8	...
9	...	9	...	9	...	9	..	9	1.24	9	...
10	...	10	...	10	...	10	.21	10	.17	10	...
11	...	11	...	11	...	11	...	11	...	11	...
12	.32	12	..	12	...	12	.24	12	...	12	...
13	.32	13	...	13	...	13	.07	13	.08	13	.05
14	.58	14	...	14	...	14	.19	14	1 53	14	.03
15	.24	15	...	15	...	15	2.75	15	.17	15	.07
16	...	16	...	16	...	16	...	16	1.92	16	...
17	...	17	...	17	...	17	.20	17	1.60	17	..
18	.03	18	...	18	...	18	...	18	.10	18	1.58
19	...	19	...	19	...	19	1.10	19	...	19	.43
20	...	20	...	20	...	20	.14	20	...	20	...
21	...	21		21	..	21	.07	21	.16	21	.06
22	...	22	..	22	.10	22	.49	22	.05	22	...
23	...	23	...	23	05	23	.36	23	...	23	1.92
24	...	24	...	24	...	24	.12	24	...	24	2.15
25	...	25	...	25	...	25	1.05	25	...	25	2.25
26	...	26	...	26	...	26	...	26	...	26	...
27	...	27	...	27	...	27	1.42	27	...	27	...
28	.72	28	...	28	...	28	.09	28	...	28	.22
29	..			29	.08	29	...	29	.48	29	...
30	...			30	1.12	30	1.22	30	.37	30	93
31	...			31	...			31	...		
	2.65		.12		2.76		14.80		10.21		14.91

RAINFALL at the head of the Waterfall Gardens, Penang during the second half of the year 1918, in inches.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Data kindly supplied by the Municipal Commissioners of George town, Penang.

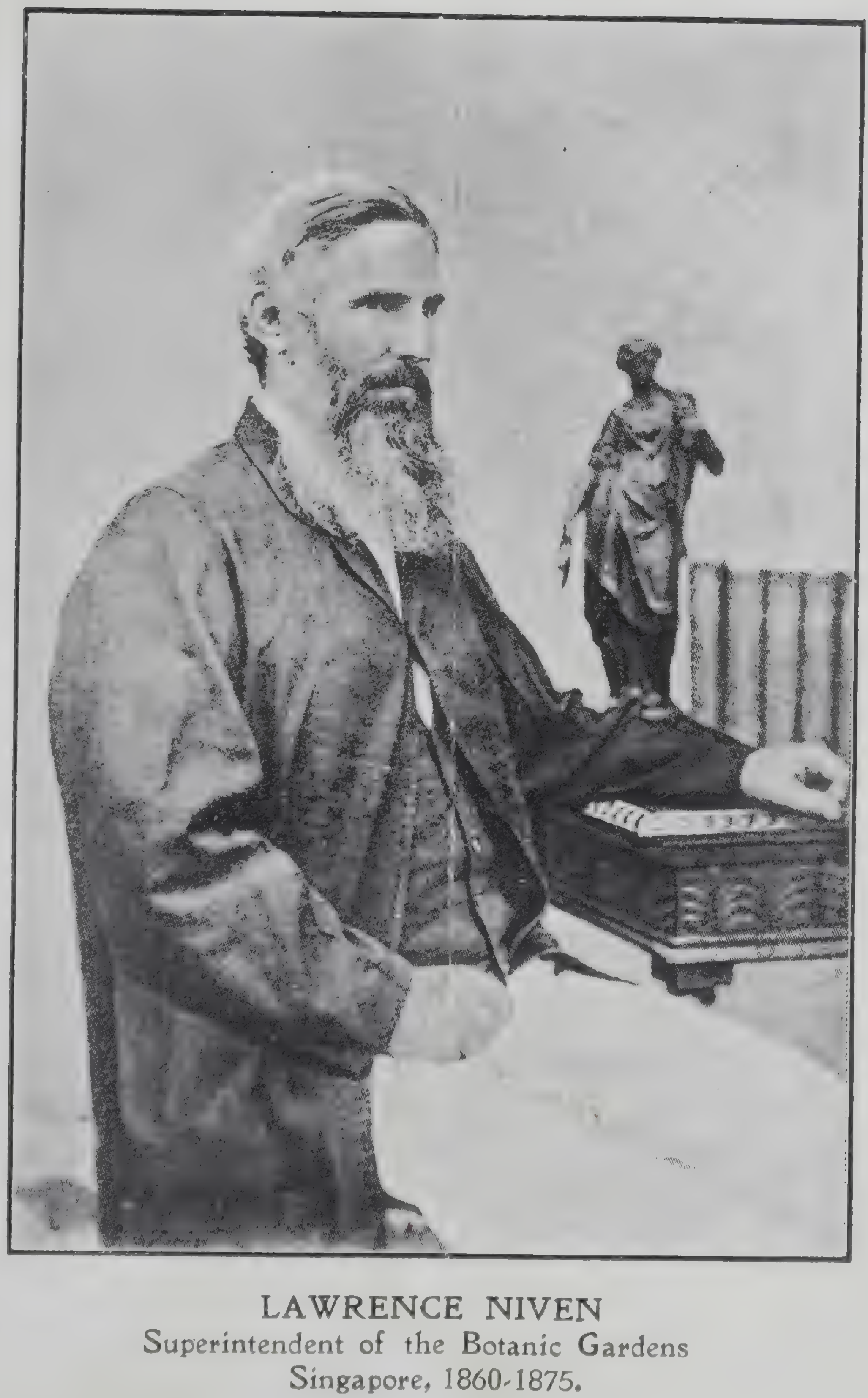
July.		August.		September.		October.		November.		December.	
Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.	Date.	Inches.
1	.28	1	...	1	...	1	...	1	.12	1	.10
2	...	2	...	2	...	2	.03	2	.10	2	.19
3	...	3	...	3	...	3	1.55	3	1.08	3	.95
4	...	4	...	4	.68	4	2.65	4	.39	4	.05
5	...	5	.24	5	2.42	5	.17	5	.19	5	.16
6	.04	6	.02	6	.14	6	2.30	6	.19	6	...
7	...	7	.62	7	.60	7	.11	7	.25	7	.03*
8	...	8	...	8	...	8	.40	8	.15	8	2.03
9	...	9	.23	9	.72	9	2.08	9	.79	9	..
10	...	10	.09	10	.24	10	.69	10	1.31	10	.05
11	...	11	.26	11	1 05	11	.62	11	...	11	...
12	.33	12	,09	12	.03	12	.30	12	...	12	.66
13	.08	13	.72	13	.06	13	...	13	1.53	13	.21
14	90	14	.32	14	.03	14	.11	14	.72	14	...
15	.15	15	.87	15	...	15	.42	15	1.45	15	...
16	.13	16	...	16	...	16	.75	16	.82	16	...
17	.40	17	...	17	1.76	17	.37	17	.12	17	..
18	.44	18	.26	18	87	18	.53	18	...	18	.16
19	.83	19	...	19	...	19	.13	19	.22	19	1 30
20	.38	20	...	20	3.27	20	58	20	1 35	20	.33
21	.07	21	...	21	1 47	21	.26	21	1.18	21	.10
22	...	22	.84	22	.72	22	...	22	...	22	.70
23	...	23	.39	23	1.30	23	.44	23	. 2	23	.09
24	...	24	...	24	.47	24	.24	24	.03	24	.29
25	...	25	1.22	25	.75	25	.13	25	.45	25	...
26	1.25	26	1.64	26	.54	26	.29	26	.16	26	.06
27	...	27	.32	27	.24	27	.24	27	...	27	1 03
28	...	28	...	28	..	28	.03	28	...	28	...
29	.19	29	...	29	..	29	03	29	...	29	..
30	.03	30	.08	30	.06	30	.12	30	1.85	30	...
31	.34	31	.32			31	.08			31	..
	5.84		8.53		17.42		15.65		14.57		8.49

*More than 8 inches probably fell and by reason of some accident went unrecorded.

SUMMARY OF RAINFALL.

	SINGAPORE.			PENANG.		
	No. of rainy days.	Amount of rain in inches.	Longest spell without rain.	No. of rainy days.	Amount of rain in inches.	Longest Spell without rain.
January - -	25	22.37	4	9	2.65	9
February -	13	2.07	6	1	0.12	21
March - -	12	2.16	10	5	2.76	19
April - -	22	10.74	2	21	14.80	2
May - -	22	8,21	5	17	10.21	6
June - -	22	11.69	3	18	14.91	5
July - -	16	5 29	4	16	5.84	5
August - -	15	5.77	7	18	8.53	4
September -	20	8.88	2	21	17.42	3
October - -	17	6.39	8	28	15.65	1
November -	25	6 38	2	23	14.57	3
December -	23	9.12	2	19	8.49	4
Total ...	232	99.07	——	196	115.95	——

	Singapore		Penang	
Greatest amount in 24 hours ...	6.07		Uncertain, possibly 8.00 but recorded	3.27
,, ,, 48 ,, ...	11.49			4.74
,, ,, 72 ,, ...	16.11			5.46
Excessively rainy periods, more than 5.00 having fallen in 72 hours (January)	1		(Sept., Oct., Dec.)	3
No. of days when the condition on persisted.	3			3
Periods of comparative drought less than 0 02 having fallen in 120 hours (January, February, March, May, August, October)	7		(Jan. 2, Feb , Mch. 2, May, June., July.)	9
Number of days when the condition existed.	38			45



LAWRENCE NIVEN
Superintendent of the Botanic Gardens
Singapore, 1860-1875.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. II. Issued January, 31st 1920. No. 6.

Mr. Lawrence Niven.

Mr. Lawrence Niven commenced work at the Botanical Gardens almost as soon as they were opened by the "Singapore Agri-horticultural Society," which was formed in 1859. The Gardens were developed in 1861-62 and after successful shows in the former year, it is recorded that "The Society had obtained the part time services of Mr. Lawrence Niven as Superintendent." Mr. Niven was also superintendent of an adjoining nutmeg plantation, so that he could combine the two very well. He earned the thanks of the Committee for "his taste in laying out the Gardens," and Mr. Buckley records that he made the Gardens very attractive by large beds of pretty flowers. He is also mentioned with praise in the Gardens Guide published in 1889. The title of his office, which was more honorary than remunerative, was changed in 1874 to Manager, the Government then taking over the Gardens. Mr. Niven retained charge until the arrival of Mr. James Murton in 1875.

W. MAKEPEACE.

A Guide to the Palm Collection in the Botanic Gardens, Singapore.

But two brief notes have so far been published on the fine collection of Palms growing in the Botanic Gardens, Singapore. The first in the "Agricultural Bulletin, S. and F. M. S." (Vol. III, p. 249) in 1904, the second in the same Journal (Vol. V, p. 6) in 1906, both presumably by Mr. Ridley. In the fourteen years since the last article was written many additions, and it is feared several losses, have to be recorded and accordingly it seemed desirable thoroughly to investigate the collection again.. The present paper is the outcome of this work.

In the first paper of Mr. Ridley, entitled "The Palm Collection of the Botanic Gardens, Singapore," the cultivation and pests of the palms has been rather fully treated, and a list of the palms

in cultivation in the Gardens is appended. In the second paper is a list of new palms introduced into the collection since the publication of the earlier paper.

The present paper is written with the object of drawing attention to the collection and in providing a guide and brief description for visitors to the Gardens, who are interested in Palms. It has been written in a semipopular style accordingly and botanical terminology, synonymy, and citations of other works are given as sparingly as possible. A short description of the collection is first given with a general comparison of the prominent features of the palms. This is followed by a list of the genera represented and a brief note on each species, sufficient to enable them to determined at sight.

Only those species whose identity has been established either from actual determination or from previous records as found on the labels have been mentioned. There are still several not yet named, many of them quite young, but until they produce flowers and fruit it is impossible to determine them accurately and they have accordingly been omitted.

The collection of palms is quite a representative one, including species from most tropical countries. No special arrangement, except in one or two instances, has been followed in planting and the result is by no means displeasing. A fairly large piece of ground near the Gardens Office, has been exclusively planted up with palms, and from the lower end of Maranta Avenue down to the Plant Nursery there extends what is known as the Palm Valley, and as the name implies, the valley has been reserved almost entirely for palm specimens. On the west side, several species have been quite successfully planted in clumps, notably—*Ptychosperma McArthuri,* Wendl., *Cyrtostachys Lakka,* Becc., *Martinezia caryotaefolia,* H. B. K., *Pinanga Kuhlii,* Bl., *Rhopaloblaste hexandra,* Scheff., *Oncosperma filamentosa,* Bl., *Heterospathe elata,* Scheff., *Oreodoxa regia,* H. B. K., *Stevensonia grandifolia,* Dunc., *Verschaffeltia splendida,* Wendl., *Ptychoraphis angusta,* Becc.

Apart from these two special places, many specimens are scattered over the remainder of the Gardens. Small avenues have been planted in one or two places, as for example, the avenue of *Arenga saccharifera,* Labill., near the Tyersall Road entrance. There is also an avenue of *Sabal Palmelto,* Lodd., another not quite complete of *Rhopaloblaste hexandra,* Scheff., interplanted with *Phoenix rupicola,* Anders. This latter gives quite a pleasing effect, the tall *Rhopaloblaste hexandra* with its drooping leaflets, and the beautiful curved leaves of *Phoenix rupicola,* make a very pretty picture. Another avenue which must be mentioned, is of *Cyrtostachys Lakka,* Becc., the "Pinang Rajah," "Sealing Wax Palm," or "Red-stemmed Palm." This avenue contains fine specimens of this beautiful palm, so distinct from all others on account of what appears to be a red stem, but is actually the red sheathing bases of the leaves. The remaining plants have either

been planted in rows of single species, or more generally as isolated plants with a view to their developing into worthy representatives of their species. On the whole this latter ideal has been attained and a few very fine specimens might be mentioned such as, *Attalea Cohune,* Mart., near the lake, *Corypha Gebanga,* Bl., near the Herbarium, a young plant of *Latania Commersonii,* L., near the Office, and two very tall specimens of *Livistona altissima,* Zoll., on the Bandstand Hill, and many specimens of *Oncosperma filamentosa,* Bl. (Nibong) and *Elaeis guineensis,* Jacq. Altogether there are about 1085 specimens planted in the Gardens embracing upwards of 120 species and 60 genera.

A Comparison of General Characters.

The variation in growth of the palms allows them to be grouped under three heads:—

(1) Those which are soboliferous, that is whose stems grow in clumps such as *Caryota mitis,* Lour., *Cyrtostachys Lakka,* Becc., *Oncosperma filamentosa,* Bl.

(2) Those which are soboliferous but are not self-supporting, obtaining their support from surrounding trees. This section includes the many species of *Calamus, Korthalsia* and *Daemonorops,* and amongst which are many plants of considerable economic importance. Some grow to a great height, topping the highest of our jungle trees. Examples may be seen in the piece of virgin jungle preserved in the gardens, especially at the top end of Maranta Avenue.

(3) Those palms which are single-stemmed, bearing in some cases a magnificent crown of leaves as in *Corypha,* or in other cases a comparatively small one as in the tall *Livistonas,* and *Archontophoenix Alexandra,* Wendl.

A Description of Palms in General.

Root. Generally speaking palms have no tap-roots. After germination the primary root perishes and is replaced by adventitious roots springing from the base of the stem. In *Verschaffeltia splendida,* Wendl., roots are produced up to 2 or 3 ft., and even more above the surface of the ground. These grow downwards and finally become fixed in the soil giving the plant a firm footing. In others such as *Rhapis,* and *Pinanga,* suckers are produced which send up stems and leaves, soon forming fine clumps.

Stem. The height or length of the stem varies considerably and in some cases there is hardly any stem at all as in *Sabal acaulis.* In others however, they may be of any height or length, some specimens of *Calamus* being as much as 300 ft. Except for the last mentioned, no specimen in the Gardens exceeds 80 ft., this height being attained by two specimens of *Livistona altissima,* Zoll., on the Bandstand Hill. As a general rule single-stemmed palms attain to a greater height than soboliferous or several-stemmed palms. In diameter stems vary considerably, from 1-2 inches

in the slender *Calamus*, *Ptychosperma*, etc., to the very substantial looking trunks of *Oreodoxa*, *Metroxylon*, *Borassus*, and *Corypha*, which in some specimens are anything from 3-5 feet.

In *Oreodoxa regia*, H. B. K., the trunk is quite smooth, while in *Archontophoenix Alexandrae*, Wendl., it is ringed by the scars of the old leaves. Other species such as *Attalea Cohune*, Mart., and *Elaeis guineensis*, Jacq,. retain the bases of the old leaves which gives them a rugged appearance. Ferns and orchids often obtain a footing in these leaf bases presenting a typically tropical effect. In *Caryota urens*, L., the sheathing bases remain round the stem after the leaves have fallen and are bound together with a dense mass of fibres. Yet other palms have spiny trunks as for example, *Oncosperma horrida*, Scheff., and *O. fasciculata*, Thw.

Very few of the palms have branched trunks. One species *Hyphaene indica*, Becc., is represented in the gardens, but the plants are quite small and are only about six months old.

The Rattans (*Calamus*, etc.,) are almost the only palms whose stems are not self-supporting.

LEAF. As new leaves are produced the old leaves generally die off and fall away. By this means in most cases a fine trunk is produced, surmounted by a magnificent crown of leaves. It is this crown of leaves which gives such a distinctive beauty to palms in general. They vary considerably in size, from the small-leaved *Rhapis flabelliformis*, L'Herit, to the gigantic leaved *Teysmannia altifrons*, Miq.

The variation in the shape of the leaf is considerable, but may be considered under two heads:—

(1) Palmate, in which the leaves are characteristically fan-shaped and

(2) Pinnate, in which the leaves are cut similar to a feather.

Examples of the first are *Livistona*, and *Thrinax*, of the latter *Ptychosperma*, *Cyrtostachys*, and *Oncosperma*.

Feather leaved palms have on the whole very much larger leaves than fan palms. The length of some of them being as much as 30 ft., and their width 8 ft. However, none quite so large are to be seen at present in the Gardens. The angle which the leaf makes with the stem varies according to the age of the leaf. At first when opening, a leaf is almost upright, but as it developes its weight bends it down and the falling away of the lower leaves causes it to hang lower until it in its turn dies and falls away. The leaves of fan palms as a rule form a larger angle with the stem than those of the feather palms. The reason being, that the weight is less evenly distributed, being placed at the end of the petiole, instead of almost the whole length of the leaf as in the latter.

Considerable variation is found in the leaflets. In the pinnate section their relative positions on the leaf-rachis give a distinctive appearance to many species. A few examples in both sections will emphasize this. In the palmate section, one finds in *Pritchardia*

In the Palm valley, Singapore.

grandis, Seem., that the whole of the leaflets seem to be joined up to form one deeply furrowed leaf, having a very strongly-toothed margin. Other species of the same genus *L. peltata*, Roxb., for example are divided almost to the base, producing furrowed leaflets which are very broad and strongly toothed at the apex, narrowing to the base, giving them almost a triangular shape. Good examples of fan-leaves are found in *Thrinax* and *Livistona* in which they are divided from $\frac{1}{4}$ to $\frac{1}{2}$ the length of the leaf. This is the general type of fan-palm.

In the pinnate section the angle which the leaflet forms with the leaf-rachis varies considerably. For instance in *Archontophoenix*, and *Cyrtostachys*, the leaflet is placed more or less at right angles to the rachis forming a fairly flat-leaf. On the other hand in *Rhopaloblaste* and *Oncosperma*, the angle is much greater giving a drooping appearance which is very attractive. The leaflets are generally arranged in two rows one each side the rachis, and as they are more or less opposite, they produce a flat leaf. This is the general arrangement for pinnate-leaved palms. A departure from this method is found in some species, as for instance in *Raphia Hookeri*, M. and W.. Here the leaflets appear to be arranged in four rows, two each side of the rachis. This is due to their being placed at different angles. The two bottom rows, one each side of the rachis, consist of alternate twos or threes placed at the usual angle, while the two upper rows, are the remaining leaflets placed at a very much more acute angle, thus giving the appearance of four rows, whereas in reality there are but two. This arrangement gives a very different appearance to this type of palm, and one fine specimen in the gardens makes a noble-looking plant. Another very distinctive form is that of *Caryota urens*, L. In this species the leaves are bipinnate or decompound, quite an unusual form in the palm-family. In fact this plant appears more like a gigantic tree-fern. One other genus should be mentioned, namely, *Martinezia* from America. In *M. caryotaefolia*, H. B. K., the leaflets, which are of peculiar shape, are placed at intervals in threes and fours on the rachis, the spaces between being clothed with very sharp spines.

The petioles of several species are armed with spines. When allied with spiny stems they form a very formidable barrier in the jungle. Mention has been made of the spiny leaf-rachis of *Martinezia*, this plant has also a very spiny stem. The same combination is found in *Oncosperma horrida*, Scheff., though the leaf-rachis of this species is not so spiny as that of *Martinezia*. Many palms have spines on the petiole only, such as *Livistona*, and *Elaeis*.

The stems and leaves of *Calamus*, and *Korthalsia*, are generally provided with numerous recurved spines, and the leaf rachis is often produced into a barbed, whip-like structure. These spines which are reflexed enable the plants to climb over the surrounding shrubs and to the tops of the highest trees.

The many different positions assumed by the leaves are often taken up to protect the plants from the effects of too intensive

sunlight and the violence of wind and rain. This arrangement adds very much in some cases to the beauty of the plant. *Phoenix rupicola,* Anders., affords an excellent example. The curve affected by the leaves of this plant renders it more beautiful than would be the case were the leaves straight.

FLOWERS. These are produced in large numbers on large and much-branched inflorescences. They are frequently embedded in the fleshy surface of the branches, and belong to a type of inflorescence known as a spadix. In almost all palms the inflorescences are axillary, only in one or two cases are they produced terminally, as in *Metroxylon,* and *Corypha.* Each inflorescence when in bud, is enclosed in a protective structure called a spathe. This is burst by the growing inflorescence and falls off at once, or sometimes remains to sheathe the stalk and lower branches. The flowers are very small and individually insignificant, but are produced in enormous quantities, thousands often being borne on one inflorescence. Collectively they often present a handsome appearance. They are sessile, and as a rule unisexual, the male and female occupying different parts of the same inflorescence. Very rarely hermaphrodite flowers are produced. In some cases female flowers are borne on the lower branches of the spadix with the male flowers densely packed on the upper. In others as for example in *Pinanga* the female flowers are placed between the male flowers and it is so arranged that two male flowers appear in succession and then the female, thereby making the spike unisexual for the time being. As palms are monocotyledonous plants the general arrangement of the flower is trimerous, that is 3 sepals, 3 petals, 6, or a multiple, stamens, and 3 carpels. In the male flowers the carpels are rudimentary and are called pistillodes and in the female flowers the stamens are rudimentary and are termed staminodes. Pollen is produced in great quantities and probably wind is one of the chief agents in pollination. Bees also play an important part in this matter. Also the writer has seen flower spikes literally swarming with a large type of ant and it seems probable that pollination might be carried out by them. The ovary generally consists of three carpels either quite free or completely united.

FRUIT. The fruit is either a berry or a drupe. Two of the carpels may be abortive as in the Coconut, or if the carpels are free, a syncarp of one-seeded fruits results, or again if united, a single fruit with one, two or three seeds, according to the number of ovules which develop is the result. The fruits are on the whole small when compared with the size of the plant, that of the Coconut being one of the largest. This is, however, quite dwarfed by the huge fruit of the Double Coconut (*Lodoicea sechellarum,* Labill.), from the Seychelles.

SEEDS. The seeds are of various shapes and sizes. They are round in the Coconut, owing to one ovule only as a rule having developed, whilst in the Date, (*Phoenix dactylifera,* L.), they are long and narrow. Where three seeds are produced two sides are often flattened.

CULTIVATION. A few notes on the general cultivation and propagation of palms in the tropics would it is thought be of use. This has been fully dealt with in "The Agricultural Bulletin S. and F. M. S.," Vol. III, page 250. The following extract is taken from that journal as the notes there given are equally applicable now.

"Although far the greater number of palms are natives of tropical regions a small number inhabit cooler, sub-tropical, or almost temperate regions. Such are *Chamaerops humilis* of Southern Europe, *Nannorhops Ritchieana* of Afghanistan, *Trachycarpus excelsus* of Japan, *Rhapis humilis* of Japan, *Kentia sapida* of New Zealand, and *Pseudophoenix Sargentii* of Florida.

"These cooler climate palms are much less easy to cultivate here and seldom thrive when planted out, although they may be kept as pot or tub plants for a long time.

"There are also a few desert palms, which are also difficult to grow on account of our heavy rainfall, such are *Hyphaenes*, the common date, (*Phoenix dactylifera*), which, however, can be made to grow but has never flowered with us. The Palmyra or Lontar palm (*Borassus*) introduced to India from Africa and thence to the Peninsula, thrives near the sea in sandy places, but seems difficult to grow far inland, and even in the drier parts of Singapore is not at all easy to grow satisfactorily. The Nipa palm so abundant in the tidal swamps does not grow well away from salt mud.

"Exclusive of these almost all the palms from different parts of the world which have been introduced into Singapore have done well and many have flowered and fruited successfully and are readily cultivated.

"SEEDS. Generally speaking palms are reproduced from seeds, in a few instances propagation by means of division or root cuttings is the method adopted. The principal genera from which root cuttings may be obtained are:—*Pinanga, Cyrtostachys, Oncosperma, Iriartea, Oenocarpus, Chamaedorea, Chrysalidocarpus, Wallichia, Arenga, Caryota, Nipa, Licuala, Rhapis, Calamus, Zalacca, Korthalsia, Raphia, Bactris, Desmorcus, Astrocaryum,* and *Sagus*. With these an underground creeping rhizome produces a new growth and it is best to cut or ring this rhizome behind the growth and when a tuft of roots has been formed the cutting may be removed. Root cuttings, however, seldom make nice shapely plants, the process is usually a slow one and the percentage of loss generally heavy, for these reasons when procurable seeds are always preferred.

"In collecting palm seeds it is essential that the seed should be perfectly ripe. This is generally easily determined by the hardness of the seed, that is to say of the albumen, and also by the colour and softness of the fruit, occasionally the albumen seems to be fairly hard before the fruit is ripe enough to germinate. The colour of the fruit is often a help, thus, in *Iguanura* the fruit is first white, then becomes red, and at last black, and when it has arrived at this colour only it is ripe enough for collecting.

"The fruits of palms may be fleshy, fibrous or even woody, and a few have a spiny spathe which has to be guarded against. Fleshy fruits soon ferment and the pulp is easily removed. Fibrous fruits may be macerated for a day or two when the outer covering can be split or peeled off. The Malayan "Kabong" is one of the worst to handle, the juice from the fruits being a skin poison. The Kitool (*Caryota urens*) is also a powerful irritant on the skin. Many palms germinate freely when left to themselves, under cultivation however it is best to remove the outer covering of the seed because of the decay of the pulp or fibrous covering and possible loss from fungus. The period of germination varies from 6 weeks with some to 3 or 4 years with others. Excepting, those palms requiring much space, Coconuts, Sago, it is best to plant seeds in pots or boxes, whichever is used the drainage should be deep and well covered with half decayed leaves to prevent the compost from blocking up the drainage. The compost to be used should be free from fungi and consist of burnt earth, well decayed leaf-mould, some sand, and a little powdered charcoal. Seeds may be planted fairly close, small seeds placed upright, large seeds on one side, or flat, and covered with one-half to one inch of the prepared compost which has been passed through a seive of a fine mesh. After planting the pots or boxes should be thoroughly watered (saturated) placed in a moderately damp situation and afterwards sufficiently sprinkled so as never to be over wet or too dry. Palm seeds when planted must be guarded from rats and mice, and white ants, the surface soil inspected, and excessive damp and fungus removed. The growth is often at first very slow (this is especially noticeable in rattans) but after a year or two the growth increases much more rapidly.

"Seedlings. With most of the best known palms seedlings may be described as fairly hardy and only ordinary attention is necessary to produce strong plants, most failures occur through excessive damp or watering, and the moisture remaining in the axils of the leaves, or because the surface soil is too damp in which case the seedling perishes. A few species of palms have been introduced to cultivation by seedlings collected in the jungle of which seeds have not been procurable. Owing to the different conditions under which such seedlings have germinated care must be taken to wrap the roots in mud immediately on lifting them and the seedlings dug up with a good ball of earth attached to them. The little plants must be kept very moist till they can be planted, and not allowed to get dry by exposure to the sun or they speedily perish. Some jungle palms stand transport fairly well, especially rattans and with some species it is the only way to get them.

"Re-potting. As soon as seedling palms have filled their pots with roots, the young plants should be transplanted or repotted into single pots and a strong compost used. Some loamy soil, well decayed cow manure and leaf-mould, some sand and burnt earth, all well mixed together and passed through a moderately coarse sieve. Let the drainage be sufficient and placed carefully. All loose

and old sour soil removed from the plants, the roots inspected if sound and free from pests, keep lightly syringed for a few days and water sparingly until the plants are established. Palms succeed best when potted or planted deeply, unlike flowering plants the lower roots of palms in thickening raise the plant, and the surface or adventitious roots grow upwards. In repotting or tubbing very strong plants of which the roots have become tightly bound together it is not necessary to disturb the ball or place new drainage underneath it, but a little additional drainage could be placed round the base, and though the plants may appear deeply tubbed at first the surface roots will soon appear on the top."

SELECTION OF SPECIES. The decorative value of palms is so great as to merit their being placed high in the list of decorative plants. The following hints are given with a view to assisting in selection and planting. Having obtained good strong plants, the question arises as to what should be done with them to obtain the best results. This is important as in the case of plants required for household decoration and around the bungalow, it is imperative that the species which make the best pot plants are chosen. In addition it is very necessary to know which species require shade and vice versa. This applies to garden planting generally.

POT PLANTS. For this purpose the following species are generally considered best.—*Phoenix rupicola*, Anders., *Thrinax argentea*, Lodd., *Thrinax barbadensis*, Lodd., *Licuala peltata*, Roxb., *Pritchardia grandis*, Seem., *Livistona australis*, Mart., *Livistona chinensis*, Br., *Livistona altissima*, Zoll., *Calamus Lindeni*, Hort., *Caryota mitis*, Lour., *Arenga Engleri*, Becc., *Hyophorbe amaricaulis*, Mart., *Heterospathe elata*, Scheff., *Verschaffeltia splendida*, Wendl., *Ptychosperma McArthuri*, Wendl., *Ptychosperma Sanderiana*, Ridl., *Elaeis guineensis*, Jacq., *Cocos plumosa*, Lodd., *Martinezia caryotaefolia*, H. B. K., *Stevensonia grandifolia*, Dunc., *Rhopaloblaste hexandra*, Scheff., *Chrysalidocarpus lutescens*, Wendl.

Shade is necessary for *Pritchardia grandis*, Seem. and *Ptychosperma Sanderiana*, Ridl., a little shade is appreciated by the majority of the others.

All the above when they have grown too large for pots or tubs, can be planted out in situations which follow the lines already laid down as regards shade.

SPECIMEN PLANTS. The following species are recommended for planting out in the grounds as specimen plants.—

(*a*) Several-stemmed species—*Chrysalidocarpus lutescens*, Wendl., *Rhapis flabelliformis*, L'Herit., *Caryota mitis*, Lour., *Arenga undulataefolia*, Becc., *Oncosperma filamentosa*, Bl., *Cyrtostachys Lakka*, Becc., *Ptychosperma McArthuri*, Wendl. The above do not require much shade. Some of these species are particularly useful for filling in gaps and where a clump is desirable. It may be mentioned in passing that though very effective *Cyrtostachys Lakka*, Becc., the Pinang Rajah, is a rather slow grower.

Pinanga Kuhlii, Bl., *Pinanga patula*, Bl., and *Ptychosperma Sanderiana*, Ridl., require shade.

(*b*) Single-stemmed species—*Acanthorhiza aculeata,* Wendl., *Livistona altissima,* Zoll., *L. australis,* Mart., *Latania Commersonii,* L., *Caryota urens,* L., *Elaeis guineensis,* Jacq., *Cocos plumosa,* Lodd., *Martinezia caryotaefolia,* H. B. K., *Phoenix rupicola,* Anders., *Dypsis madagascariensis,* Hort., *Oreodoxa regia,* H. B. K., *Actinorhytis calapparia,* Wendl., *Dictyosperma album,* W. and D., *Archontophoenix Alexandrae,* Wendl. None of these require much shade.

Avenue Plants. Many palms lend themselves for this kind of work and the following have proved very effective.—

Sabal palmetto, Lodd., *Caryota urens,* L., *Dypsis madagascariensis,* Hort., *Oreodoxa regia,* H. B. K., *Cocos plumosa,* Lodd., and *Arenga saccharifera,* Labill., all of which are sun rather than shade loving plants.

F. Flippance.

(*To be continued*).

THE FUNGUS FLORA OF HEVEA BRASILIENSIS.

A little while ago an enquiry was received asking what were the fungus diseases of *Hevea brasiliensis.* On consulting the literature on this subject it was ascertained that there was no recent complete enumeration of the diseases that have been found to attack this tree in Malaya. Such lists have been prepared for other countries, as for instance by Petch for the *Hevea* in Ceylon, but the diseases are not necessarily the same in different countries and it seemed desirable therefore to have a list for Malaya.

At the same time the present paper goes further than recording the diseases that have actually been proved and enumerates all fungi, both those that are known to be parasitic and those that are so far regarded as saprophytic, which have been found on Hevea locally.

The importance of having such a list is ably reasoned by Professor C. F. Baker in Vol. II, No. 4 of the "Gardens Bulletin," in his article "Hevea versus Fungi."

The records from which this compilation is made are the works and collections of H. N. Ridley, W. J. Gallagher, K. Bancroft, A. Sharples, W. N. C. Belgrave, R. M. Richards, and C. F. Baker.

It is considered that additions will have to be made to this list from time to time as further investigations produce new records.

Ridley in "The Agricultural Bulletin, Straits Settlements and Federated Malay States," Vol. X, 1911, page 141, quoting M. George Vernet gives on page 143 "a list of all pests recorded to the plant," and numerates 25 species of fungus, ending with the comment, "This may seem a formidable list but it is really small compared with the pests which attract most cultivated plants."

The same remark may equally well apply to the present list but it is to be hoped that the latter part of it may now be modified considerably. One might indeed at first wonder whether the *Hevea* tree would grow at all under the burden of such a number of uninvited guests, and so far no other kind of tree in Malaya has so many fungi observed on it. It must be remembered however that the chief reason so many fungi are here recorded is that so much individual attention has been paid to the *Hevea* by Malayan mycologists. There is no doubt that an equally large number of fungi would be found on any other tree grown under similar conditions and studied so assiduously and sympathetically by experts.

In the present list the fungi are grouped according to their respective habitats. It will be seen that all parts of the tree carry their quota and that all the great groups of fungi are represented.

Root and Collar.

Fomes lignosus, Klotsch (*Polyporaceae*). An orange coloured bracket fungus, probably the best known of rubber diseases. Previously, this fungus was known as *F. semitostus,* Sacc, owing to a wrong determination in the first instance. The first specimens in Malay were collected by Ridley in 1896 and forwarded to Kew. Considerable work has been carried out in connection with it chiefly by Gallagher and Bancroft, and is published in the bulletin of the Department of Agriculture, Federated Malay States.

Fomes pseudoferreus, Wakefield (*Polyporaceae*). The "Wet Rot" of Hevea, previously described under *Poria hypolateritia.* Investigated by Belgrave in 1917-1919.

Helicobasidium, (?) *H. mompa,* Tanaka (*Thelephoraceae*). The specimens which were collected by Ridley in Selangor in 1901 were sterile, and could not be definitely determined. Massee considered them a species of *Helicobasidium* probably *H. mompa* which is very destructive to the mulberry in Japan. No further collections of this fungus have been recorded.

Hymenochaete noxia, Berk. (*Thelephoraceae*). A common brown root disease.

Irpex flavus, Klotsch. (*Hydnaceae*). A bright yellow woody fungus first collected on rubber by Ridley in 1897. Bancroft's investigations are published in the bulletins of the Department of Agriculture Federated Malay States. It is considered to be parastic.

Marasmius rotalis, B. et Br. (*Agricaceae*). Bancroft records the mycelium of this fungus as occuring at the base of trees, like " horse hair."

Poria hypolaterita, Berk. (*Polyporaceae*). Investigated by Belgrave and orginally determined as this species at Ceylon. Later a re-determination has referred the specimens to *Fomes psudoferreus.*

Ustulina zonata, Sacc. (*Sphaeriaceae*). A black crustaceous fungus which attacks the trees at their collar causing loss of foliage

and "die back." Investigated by Brooks and Sharples and recorded in the bulletins of the Agricultural Department, Federated Malay States.

Xylaria cynoglossa, Cooke (*Sphaeriaceae*). A small pale coloured tongue-shaped fungus recorded by Bancroft.

Stem and Branches.

Apiosporium atrum, Massee (*Perisporiaceae*). Found on dead branches. Bancroft does not consider it a parasite.

Asterina tenuissima, Petch, (*Perisporiaceae*). Petch considers that this mould lives on the sugary secretions of the nectaries at the base of the leaves.

Botryodiplodia theobromae, Pat. (*Sphaerioidaceae*). Reported by R. M. Richards as a cause of "Dieback."

Cephalosporium, sp. (*Mucedinaceae*). Recorded by Belgrave as one of the fungi present in "mouldy rot" on tapped surfaces. He also found it a parasite on *Hemilea vastatrix.*

Corticium calceum, Fries, (*Thelephoraceae*). A bark fungus determined by Massee in 1906.

Corticium javanicum, Zimm. (*Thelephoraceae*). A cause of "Pink Disease."

Corticium salmonicolor, B. et. Br. (*Thelephoraceae*). The cause of "Pink Disease." Described in detail by Brooks and Sharples in the bulletins of the Agricultural Department, Federated Malay States.

Cryptovalsa microspora, Sacc. (*Sphaeriaceae*). A new species found by C. F. Baker on rotting stems.

Cyphella heveae, Massee (*Thelephoraceae*). A cause of "Thread blight." Found on the bark by R. M. Richards.

Daldinia concentrica, Ces. et De Not. (*Sphaeriaceae*). A dark chocolate coloured bun shaped fungus forming hard globular masses, occurring commonly on dead wood.

Daldinia concentrica, Ces. var, *escholzii,* Ehrenb. (*Sphaeriaceae*). Found on a dead trunk.

Didymella oligospora, Sacc. (*Sphaeriaceae*). Recorded by C. F. Baker on dead branches.

Diplodia rapax, Massee (*Sphaerioidaceae*). Described by Ridley as a "pestilential black fungus" and named by Massee in 1909.

Diplodia, sp. (*Sphaerioidaceae*). The cause of "Die Back." It is considered to be a wound parasite, that is to say, it can only enter its host through a dead or wounded part. The fungus itself is scarcely visible to the naked eye, and is in the form of minute black dots on the dead shoots.

Eutypa caulivora, Massee, (*Sphaeriaceae*). This fungus forms numerous large black blotches on the trunk and is considered by Massee to be a parasite. Bancroft suggests it is a "wound parasite," and quotes Petch as stating that this fungus is the same as *Nummularia pithodes.*

Eutypa ludibunda, Sacc. var. *heveana,* Sacc. (*Sphaeriaceae*). Recorded by C. F. Baker on dead limbs.

Gloeosporium alborubrum, Petch (*Melanconiaceae*). Reported on dead shoots.

Hirneola polytricha, Mont. (*Tremellaceae*). A thin dark coloured fleshy fungus occurring in clusters at the ends of dead branches or wounded parts.

Hypochnus, sp. (*Thelephoraceae*). A "thread blight" fungus.

Hypoxylon oodes, B. et. Br. (*Sphaeriaceae*). A black nodular incrusting fungus reported by Bancroft on dead branches.

Hysterium heveanum, Sacc. (*Hysteriaceae*). On dead limbs.

Lembosia glonioides, Sacc. (*Hysteriaceae*). On dead limbs.

Megalonectria pseudotricha, Speg. (*Hypocreaceae*). Bancroft describes this as a bright red minute fungus forming small round bodies the size of a pin's head. It occurs on dead bark and stems. Brooks states that *Stilbum cinnabarinum* is the conidial stage of this fungus.

Nectria diversispora, Petch (*Hypocreaceae*). A common small red fungus, saprophytic on dead bark and fruits.

Nectria sanguinea, Fries (*Hypocreaceae*). An orange red saprophytic fungus found on the bark.

Neotrotteria pulchella, Sacc. Found on the bark by C. F. Baker and described by Saccardo as a new species.

Nummularia pithodes, Petch (*Sphaeriaceae*). Reported by Brooks and Bancroft to be common on dead branches and roots. It is one of the causes of black lines in the wood. Its black fructification has the appearance of a piece of asphalt. Petch considers *Eutypa caulivora* Massee, to be the same thing.

Nummularia repandoides, Fuck. var. *singaporensis,* Sacc. (*Sphaeriaceae*). On dead limbs.

Oospora gilva, Berk. (*Mucedinaceae*). A pink powdery fungus recorded by Bancroft as occurring commonly on burnt rubber stems.

Peroneutypa heteracanthoides, Sacc. (*Sphaeriaceae*). Recorded by C. F. Baker on dead limbs.

Phyllosticta heveae, Limm. (*Sphaerioidaceae*). A disease affecting the youngest shoots and widely spread throughout the country. It is closely associated with the "die back" fungus, and Bancroft considers that in many cases of the "die back" disease the primary cause is this fungus.

Phyllosticta ramicola, Petch (*Sphaerioidaceae*). Recorded by Bancroft as a stem disease.

Phytophythora Faberi, Maub. and P. spp. (*Perenosporaceae*). Very common and destructive parasites credited with causing "Black Thread," "Stripe Canker," "Cambium Rot," and canker of the bark.

Pleonectria heveana, Sacc. (*Hypocreaceae*). On rotting stems.

Polystictus sanguineus, Fries (*Polyporaceae*). The most brilliant coloured and one of the prettiest of Malayan bracket fungi. Its colour varies from a brilliant scarlet to dark blood red. It grows on all dead wood very commonly everywhere.

Schizophyllum commune, Fr. (*Agaricaceae*). A small mushroom with a lateral stipe growing in patches over dead wood. When wet it is a fleshy colour and expanded but when dry it turns white and the edges become involute. It is densely covered with hairs and is to be found on almost any dead wood.

Sphaeronema, sp. (*Sphaerioidaceae*). Reported by Belgrave to be the cause of "mouldy rot" on the tapped surfaces.

Stilbella heveae, Limm. (*Stilbaceae*). A minute pin shaped fungus with a salmon coloured head and dark coloured stalk. Reported by Bancroft on dead bark.

Stilbum cinnabarinum, (Mont.) Lind. (*Stilbaceae*). On dead parts, reported by Brooks to be the conidial stage of *Megalonectria pseudotrichia*.

Thyridaria tarda, Bancroft (*Sphaeriaceae*). Considered by Bancroft as the perfect stage of the "Diplodia" fungus, the cause of "die back." Vincens of Saigon also does not think this should be separated from *Diplodia*.

Xylaria obovata, Berk. (*Sphaeriaceae*). On stumps.

Xylaria scopiformis, Mont. (*Sphaeriaceae*). Recorded by Ridley and Bancroft on dead wood.

Xylaria tuberiformis, Berk. (*Sphaeriaceae*). Occurring on stumps.

Leaves.

Helminthosporium heveae, Petch (*Dematiaceae*). Recorded by Ridley as attacking the young leaves and proving troublesome in nurseries.

Limacinia javanica, Sacc. (*Sphaeriaceae*). A sooty mould recorded by Bancroft as following on a scale, *Lecanium nigrum*. Such fungi live on the honey dew secreted by the insect and do not actually extract any food from the leaves, although their presence in masking the leaves is harmful in a young plant.

Pestalozzia Guepini, Desmaz (*Melanconiaceae*). This fungus first appears as small grey spots, more or less circular in shape. These spots enlarge and often coalesce and are bordered by a narrow black line. The fungus kills the chlorophyll and consequently causes the grey colour of the leaf. Recorded by Bancroft. This fungus is a very serious disease on tea.

Phyllosticta heveae, Limm. (*Sphaerioidaceae*). Recorded by Bancroft as a leaf parasite.

Sphaerella heveana, Sacc. (*Sphaeriaceae*). Recently collected on dead leaves by C. F. Baker, and considered a new species by Saccardo.

FRUIT.

Asterina tenuissima, Petch (*Perisporiaceae*). Recorded by Bancroft in 1913.

Nectria diversispora, Petch (*Hypocreaceae*). A small salmon coloured fungus on dead fruits.

PREPARED RUBBER.

Bacillus prodigiosus (*Bacteriaceae*). Reported by Bancroft as causing red spots on rubber crepe.

Chromosporium crustaceum, Sharp. (*Mucedinaceae*). Reported by Sharples as causing a black spotting in plantation crepe.

Eurotium candidum, Speg (*Perisporiaceae*). A common mould, reported by Bancroft. Sharples considers that the opaque spots on sheet might be attributed to this fungus.

Fusarium sp. (*Tuberculariaceae*). Stated by Sharples to cause a violet flush on sheet rubber. Previously Bancroft had stated this was due to *Bacillus violaceus.*

Monascus heterosporus, Schroeter (*Perisporiaceae*). Bancroft reports this fungus as causing a spotting on prepared rubber. Infection may take place from jungle wood both in the field or in the drying house.

Penicillium maculans, Sharp (*Mucedinaceae*). The cause of a yellow diffused flush on rubber. Investigated by Sharples.

Spondylocladium maculans, Bancroft (*Dematiaceae*). A cause of rubber spotting.

Trichoderma Koningi, Oud. et Konnig (*Mucedinaceae*). Considered by Sharples as the cause of blue black spot on crepe.

The above was already written when an article entitled "Disease Scares" appeared in "The India-Rubber Journal" of 15th November 1919 page 21. The situation is well summed up in the first two paragraphs as follows:—

"We do not think that anyone could visit any part of the East without being impressed with the havoc which diseases have wrought on rubber trees. Even if a visitor to the tropics does not see many rubber estates he is fairly educated on the subject by the Eastern Press. There is a possibility that many individuals who have visited the East for the first time may be led to take an exaggerated view of the danger from diseases, so far as rubber estates are concerned. We do not, as our readers know, wish to minimise the importance of the subject in relation to the future of Eastern plantations but we feel bound to say that in many cases the number of trees affected on particular estates seem to bear some ratio to the activity of the Press and the number of investigators who have reported on the properties.

"Some estates which have not allowed mycologists to visit them declare that they are free from disease. While such a condition may be possible we have very grave doubts as to whether any pro-

perty of considerable age is free from the various bark and root diseases so prevalent throughout the East. We believe that on most plantations there are plenty of affected specimens to be found if the staff is free to search for them. We have generally found that the keener the managers and assistants are the larger the number of cases reported in the usual monthly statement."

It is a matter for consideration as to whether the term "Scares" should be applied to the recording of these diseases which are obviously always with us but only occasionally reported, according to the opportunity the scientist has to investigate them or as they assume undue prominence. They may probably provide a "Scare" for the outside man who is nervous and over anxious about his investment but they should hardly be considered in that light by competent experienced managers for with the assistance of these same scientists who record these diseases, they should feel quite capable of dealing with them and holding them in check.

T. F. CHIPP.

Tuba-Root (Derris elliptica).

AS AN INSECTICIDE.

Readers of George Maxwell's "In Malay Forests" will recollect the graphic account of a fishing expedition where the Malays used the root of the Tuba-plant as fish poison.

Many plants exist in the Tropics, and notably in India, which can be put to the same purpose of killing fish, and Watts' Dictionary gives a fairly long list of them. Throughout the Malay Archipelago Tuba-root appears to be the poison most in use, and a very effective one it is in the hands of expert natives.

The interesting question arises whether the toxic properties of this root are also effectual for the destruction of insect life; for, if such were the case, its application to agriculture is naturally all indicated.

The Chinese appear to have solved the question to their satisfaction, for we know that they employ tuba extensively for the protection of their crops against injurious insects. In Sarawak, the Chinese pepper planters always have, or had (for the writer's visit dates far back) a few bushes of tuba growing alongside their vines.*

Beyond that knowledge, however, the enquiry suggests itself whether the macerated tuba-root, as used by the Chinese, acts as a stomach-poison to chewing insects, when taken with their food, as it does in the case of grasshoppers and beetles, or as a contact poison for insects which obtain their food by sucking as bugs and plant-lice generally do, or whether its toxicity is effective both as a contact and a stomach poison.

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* Tuba-root is now largely grown in Singapore.

The "Journal of Agricultural Research" of 15th August, 1919 published by the Secretary of Agriculture, Washington, has under the title *"Derris as an Insecticide"* an exhaustive article on the subject, and some of its tests and conclusions are given below.

But first, to prepare the ground, the writer may be permitted to give his own experience in the use of tuba-root in the course of his cultural work.

A believer in the orthodox standard sprays and emulsions found in text-books, the writer had only once casually tried tuba-root and that without any notable result. He gave it no further thought until, in the presence of the wholesale and persistent destruction of his bean-plots under the attacks of *"Agromyza phaseoli"* he was persuaded to give tuba a thorough and well controlled trial.

"Agromyza phaseoli," a fly, deposits its eggs under the skin of the stem of the beans, a very few days after germination of the seeds; the larvae feed on the tender tissues of the stems just below the first pair of leaves: the skin a week or so after germination, turns from green to brown and on pressing with the fingers, it is found to be hollow: the leaves fade and drop, and on splitting open the little stem, the small yellow larvae are found imbedded in the destroyed tissue.

Every plot was attacked and such is the virulence of this pest that it is quite an exception for one plant in 20 to survive. Among the many remedies employed against the pest were the following:—

Steeping the seeds in a 5% solution of corrosive sublimate. Rubbing the young stems with lime and powdered sulphur. The application of tobacco dust. Rubbing the seeds in sifted earth sprinkled over with "neem-oil" and putting some of this earth in each hole at the time of sowing.

The last device, alone, proved, to some extent, effective—about 20% of the plants being saved.

A trial of tuba was then made on a field of 8 beds, 66 feet long, with 1056 seeds of Lima Bean (Small Siéva) on the 28th October 1919. Ten ounces of tuba-root were well pounded in a wooden mortar, the juice thoroughly expressed, and the fibre exhausted in 20 gallons of water.

Tuba-water was then applied to each young plant at the rate of a cigarette tin full to 4 plants, morning and evening. This was continued for 15 days, until the plants were sufficiently established to be past all danger, which is only present during the first stage of their existence, when the stem is quite tender.

Only 16 seeds failed to germinate and of the 1040 plants that came up, not one has since died. And to-day, the plot is showing the most vigorous growth, a living testimony to the potency of the tuba-root as a plant-insect killer.

A point worthy of notice is that the "*Agromyza*" fly is there still quite manifest, and every morning, it can be seen in numbers flitting round and about the plants which it still damages to some extent: the pest has not died, but it has been completely prevented from laying its eggs in the young stems. The saving of the leaves, which it perforates to a state of fine lace, is not, by any means, an easy matter, but failing tuba-root, it is hoped, by means of sulphur dustings in the early mornings, gradually to overcome it.

The Tuba-plant "*Derris elliptica;*" in Malay *Akar Tuba,* a leguminose, may be seen growing in the Economic Gardens, as a low bush, but it is a climbing plant with a short trunk and long trailing branches. The root system is extensive and among the bundles of "*akar tuba*" sold in Chinese shops, pieces of root 8 feet long are not uncommonly found. In digging for roots in the Economic Gardens, the longest, so far found, was 5 feet in length: this shortness may be due to the unsuitability of the soil in which it grows—a soil too sandy to retain moisture in hot dry weather. According to a Chinese informant, tuba should be planted not far from water, which attracts the roots, thus favouring early development, and more frequent cuttings.

It is to be noted that the trials related in the Journal of Agricultural Research were made with dried imported roots, which implies, judging from the effects recorded, that it loses none of its potency by keeping.

Long tables are given in the course of the article with details of tests of tuba root applied as a dry powder and as a spray mixture with and without soap.

The following extracts are taken from this paper. A test was made of the effects of tuba as a contact poison on *Aphids,* with a spray mixture of 1 pound of powder to 100 gallons of water with the following results:

Number of	Percentage of Aphids living on plants at the end of						
	1st day	2nd day	3rd day	5th day	6th day	7th day	8th day
Aphids treated							
182	52.2	24.7	10.4	4.4	2.2	0.5	0.5
150	25.3	22.6	7.3	2.0	2.0	0.0	0
209	19.1	11.0	9.0	8.1	5.7	3.3	2.8
172	33.7	20.3	23.2	19.7	19.7	18,6	12.7
Average	35.0	19.6	12.7	8.5	7.4	5.6	4.0
Aphids untreated 159	96	105.6	104.4	137.1	144.6	169.7	235.2

TEST WITH TUBA POWDER USED AS A DUST.

Number of	Precentage of Aphids living on the plants at the end of							
	1st day	2nd day	3rd day	4th day	6th day	10th day	13th day	15th day
Aphids treated								
96	43.7	36.4	31.2	16.6	3.1	0.0	0.0	0.0
157	38.4	21.0	6.3	2.5	.6	0.0	0.0	0.0
111	49.5	29.7	11.7	9.0	4.5	.9	.9	0.0
235	47.6	31.0	16.5	15.3	9.7	1.2	.4	0 0
	44.8	29.5	16.4	10.8	4.5	0.5	0.3	0.0
Aphids untraet-ed. 180	103.3	128.3	146.1	179.4	231.6	315.5	315.5	3155+

These tables (two out of many) are followed with the remark:

"Reference to the two tables shows that the percentage of un-"treated "Aphis" gradually increased from the first day of the "tests onward. The increase was due to the birth of new "Aphids on the untreated plants. Aphids were also born on the "treated plants from the time the insecticide was applied, until "the reproducing mothers had died. Since, practically, all the "Aphids on the treated plants were dead at the close of the tests, "the newly born young ones must have been killed by coming in "close proximity to the particles of powder still remaining on the "plants."

EFFICIENCY OF "TUBA" AS A STOMACH POISON AGAINST VARIOUS INSECTS.

Potato Beetle larvae. Tuba used in various strengths up to 1 pound of powder to 128 galls. of water was found very effective. Practically all larvae were killed within 48 hours. Applied as dust the tests were equally conclusive.

Tent Caterpillars. All mixtures varying in strength from one pound to 8 gallons of water to 1 pound to 200 gallons were found effective.

Apple--tree branches were thoroughly sprayed and, after the foliage had dried, 20 to 40 newly hatched larvae were placed on each branch. The caterpillars began to show signs of discomfort within 48 hours and were practically all dead in from 5 to 10 days. In no case, was any material amount of feeding observed. In a second series of tests the larvae were placed on the branches and

sprayed after they had begun to form their tents. Under these conditions, sprays containing one pound of powder to 50 gallons of water and 1 pound to 100 gallons, killed all the larvae within 24 hours. When 1 pound to 200 gallons and 1 pound to 400 gallons of water were used, all the larvae were not killed within 11 days, but the few which remained alive were very small and inactive.

Used as a dust, this material killed all the treated larvae within a week.

Oak-Worms. Two small oak trees, on which about 300 caterpillars (*Anisota Senatoria*) were feeding, were sprayed thoroughly with Tuba at the rate of 1 pound of powder to 25 gallons of water: soap was added at the rate of one pound to 50 gallons, and a knapsack-sprayer was used. Within 24 hours, the larvae became inactive and ceased to feed, and at the end of 6 days no living ones could be found. As a check on this test, powdered arsenate of lead was applied at the rate of 1 pound to 50 gallons of water, and almost identical results were obtained.

Hyphantria Cunea (caterpillars which weave a web inside which they work, devouring the foliage enclosed). The caterpillars about one third grown, were killed within a week by a spray of 1 pound of powder to 5 gallons of water. Mixtures ranging from 1 pound to 50 gallons to 1 pound to 200 gallons of water were not satisfactorily effective, since nearly all of the sprayed foliage was eaten and not all of the caterpillars were killed.

Datana larvae. Two apple-trees, on which large colonies of nearly full-grown apple datanas (*Datana ministra*) were feeding, were sprayed with Tuba at the rate of 1 pound to 50 gallons of water. Twenty-four hours later, one living larva was found on one tree, and two on the other tree. The ground under the trees was thickly sprinkled with dead larvae.

Cabbage Worms. Applied at the rate of 1 pound to 25 gallons of water all the larvae in two cage-tests were killed within 24 hours.

Methods were employed to trace the tuba-powder and spray mixtures in the bodies of insects and the results show that tuba powder dusted upon insects does not pass into the trachae, but a limited amount of it may lodge in the spiracles: in order that the vapours and exhalations from a spray be effective, it is necessary for the sprayed insects to carry some of the solution on their bodies, in order that the exhalation may pass into the spiracles in as undiluted a condition as possible. After being dusted the insects seem to swallow some of the power which later may act as a stomach poison. Soap solutions containing tuba extract pass freely into the spiracles and finally reach the various tissues, but probably the extract kills by first affecting the nerve-tissue. (The above physiological conclusions are based on microscopical examinations and chemical manipulations too long and too technical to be inserted in this paper).

CONCLUSIONS.

The preceding experiments, much abridged as they are here given, show that the toxic principle of the tuba-root kills insects by acting both as a contact and as a stomach poison. It kills some insects easily, and others with difficulty, but it usually acts slowly and seems to kill by motor paralysis.

The above tests were made under strict control at the Agricultural Boards Testing Laboratory of Vienna (Va). They put beyond dispute the efficacy of tuba-root as a plant-insect poison and give it a high place among agricultural insecticides.

E. MATHIEU.

The Angsana Tree.

Yet another avenue of the Angsana tree (*Pterocarpus indicus*) has succumbed to the "disease" that has already deprived this country of some of its finest avenues. It will be recalled by many how these avenues have disappeared one after the other, first the one on the sea front in Malacca, then about 1907 one hundred trees in Penang, followed by epidemics among these trees at Tapah, Kuala Kubu, Kuala Lumpor and Taiping. A short while ago the avenue along the sea front at Singapore was also swept away. At the end of May this year (1919) some trees at the end of an avenue at Tanglin Barracks, Singapore, began to show the well known symptoms. Four months afterwards the "disease" had advanced considerably along the Avenue, but not successively taking toll of every tree for occasionally one was omitted, but so many trees were affected that it was deemed necessary to cut the avenue down. A look-out was kept for fungi but there was no opportunity to make a detailed investigation of the tissues of the trees. The only fungus collected was one of the tropical varieties of *Polyporus (Ganodermus) lucidus*, sometimes a stipitate form and sometimes more unguiculate. This is interesting as the fungi formerly collected from these trees have been *Polystictus occidentalis*, Fr., *Polystictus floridanus*, Berk., *Schizophyllum commune*, Fr., and *Polystictus hirsutus*, Fr. So far no fungus has actually been observed in the tissue.

On the other hand it is understood that this tree is generally propagated by means of cuttings. Now there are some who hold that the reason of this tree dying off in the manner it does is a question of senile decay and not of disease. The theory put forward is that the age of the individual tree must be counted from the last time its stock was grown from a seed. It is quite likely this may be many generations and correspondingly a considerable number of years. It is also to be presumed that the avenues and groups of trees which die off at the same time, in the same localities, are planted from the same stock of cuttings and would therefore be approximately the same age. In view of this the following article taken from the Gardens Chronicle Vol. LXVI, No. 4111, page 190 is of interest.

"Mr. Benedict's interesting and valuable investigations on the senile decay and loss of fruitfulness in plants contained material of special interest to fruit growers. Not the least interesting part of the paper is that in which he appeals to the opinion of that remarkable English horticulturist Thomas Andrew Knight, who, upwards of a century ago (1795) was occupied with this same problem of senility of plants. Knight in fact, came, as the result of his experiments with Apples and Pears, to the same conclusion as that reached by Mr. Benedict, and attributed to senility the gradual failure of different varieties of fruit trees. He found in his grafting experiments that the vigour of grafts was influenced by the age of the tree from which they were taken, and with the acumen of genius he appealed in support of his opinion to the common phenomena presented by certain woodland trees. He observes that certain of them, such as the Aspen, send up multitudes of root-suckers, and adds "were a tree capable of affording an internal succession of healthy plants from its roots, I think our woods must have been wholly over-run with those species of trees which propagate in this manner, as these scions from the roots always grow in the first three or four years with much greater rapidity than seedling plants.

"In another paper published in 1810 and entitled "On the Parts of Trees Primarily Impaired by Age." Knight makes the yet more remarkable comment:—"I am........disposed to attribute the disease and debility of old age in trees to an inability to produce leaves which can efficiently execute their natural office. It is true that the leaves are naturally reproduced and therefore annually new, but there is, I conceive, a very essential difference between the new leaves of an old and of a young variety." This difference after over a hundred years, would seem to have been now demonstrated.

"It may be added that Mr. Benedict has extended his observations on the veining of young and old varieties, to fruits other than the vine and he found in the case of Apples, Pears, Plums and Peaches that increasing age is accompanied by the same concentration of small veins as occurs in the vine. Hence it would seem that it might be possible to ascertain approximately the age of a tree by an examination of one of its this year's leaves!

"Finally reference should be made to the interesting but purely speculative hypotheses of old age in plants which have been advanced. Of these hypotheses that of Metchnikoff deserves mention. It may be described as the "guilty organ" hypothesis, in that he ascribes old age to the failure of one organ of the body: in the human body the large intestine is the sinner; in annual plants Metchinkoff ascribes to the flower-head the guilt of producing toxins (poison) which destroy the vegetable parts.

"Another hypothesis ascribes senility to cell specialisation. On this an unspecialised cell is immortal, but a cell, the moment it becomes a specialist at certain kinds of work puts off immortality and becomes mortal; but against this view is the fact that a

differential plant cell may resume its powers of growth and division becoming once again embryonic and thereby resuming its immortality.

"Whatever be the final verdict on Mr. Benedict's discoveries we cannot but be grateful to him for getting away from words and appealing to facts. Nor will horticulturists be slow to accept the moral that it behoves us to go on producing new varieties by cross breeding, for whether or no all existing varieties are doomed sooner or later to old age, the fact remains that there is still room for improvement among all our cultivated varieties of fruits and plants generally."

It would be interesting to have authentic records of the behaviour of Angsana trees raised from seed.

T. F. CHIPP.

Echinodia theobromae, Pat.

The following notes are in continuation of the article in the "Garden's Bulletin" Vol. II, No. 5, page 144. Further specimens of *Echinodia theobromae,* Pat. as described by Patouillard in the Bulletin de la Société Mycologique de France" Tome XXXIV, 2nd Fasc. have been obtained growing on small branches of a Quercus in the Botanic Gardens, Singapore. The smaller specimens agree entirely with the original description of Patouillard. In the larger specimens, which do not exceed 3 mm. in diameter, the older or generally middle portion of the specimens developes a typical polyporaceous tissue. The pores whose length is the same as the height of the plant, constitute the whole of the specimen except the thin crust of hyphae which is directly applied to the support, and the crust covering the outside edges of the specimens from which the stilboid fructifications arise. The transition from stilboid to porus formation is abrupt, the stilboid columns at the transition area quickly becoming the pore walls of the inner pore surface. The pore surface often presents a lenzitoid appearance. The diameter of the pores is small about 0.20 mm. No spores were found within the pores. (Singapore Field No. 5143).

T. F. CHIPP.

Paddy in the Economic Gardens.

Two adjacent fields measuring together 4398 square feet, or say, one tenth of an acre were put under Paddy on the 20th July.

The land selected is almost an ideal one for the purpose, being a flat of light sandy loam overlying a clay subsoil, which, owing to the low configuration of the ground, drains itself very slowly. After grubbing up the roots, which were heaped and burnt, the land was thoroughly broken up and strewn with the ashes. A corner of the field, 12 feet by 12 (= 144 sq. feet)* was, after 3

* Note—In Cochin China the rule generally followed is to allow, for the nursery 2 hundredths of the acreage to be planted,

hoeings, reserved for a nursery, with a small ridge on all four sides to retain the water which was poured over it from a water-hole near-bye. One coolie was then put to tread the earth to a soft mud consistency, which was then levelled and smoothed. A quantity of 4 ounces of paddy, water-tested, which is equivalent to 75 pounds for one acre, was sown on the surface.

The paddy, so-called "hill paddy," used for seed, was unfortunately a very mixed lot containing many different varieties from the purple red "pulut rice" to various shades of brown and yellow, with black awns, or yellow awns, or no awns at all. One variety showed two well defined longitudinal brown stripes on a yellow husk. Some showed later a tall habit of growth with drooping ears, others grew shorter stems with ears almost erect.

As, however, there was no time to ascertain by selection the respective qualities of each individual variety, the seed was sown as it was received.

Transplanting began in the middle of August, when the seedlings were about 12 inches high. This was done after the nursery had been thoroughly watered, so that, the soil being wet and loose, the seedlings could be taken up with a ball of earth round their roots. The planting was done by women on lines one foot apart with ten inches' space on the lines, more or less regularly. Instructions were given to plant only one seedling per hole, and this was adhered to as much as possible.

So far, the method applied had been that usually followed by natives in planting wet rice, under irrigation, except that the planting of wet rice is done when the fields are already under water, which was not the case here.

From the time of transplanting, the young plants were left to shift for themselves under the ordinary conditions which obtain for "hill" or "dry paddy," that is to say they received only the water from rains and no further labour was spent on them except a weeding before the flowering, and also that of scaring birds away, which was performed by a boy.

It may be here stated that the term "*dry paddy*" is open to misconception, for although hill paddy can be grown without irrigation, it, nevertheless, requires a considerable amount of rain at somewhat frequent intervals. Where such conditions do not prevail, where rains are not fairly dependable, the crop of so-called "*dry paddy*" has but poor prospects.

On the 10th December, about 4 months after transplanting, the cutting of the crop began at the ripest end of the field, the work henceforth was all done by Tamil women, who show quite a liking for it, and a marked expertness.

The harvesting was done by cutting the panicles with their stem down to the top leaf, the straw being left standing. Each woman having secured a handful of panicles tied it with the top leaf and laid the sheaf down to proceed further,

When the cutting was finished the sheaves were gathered and taken to a smooth piece of ground, where they were opened and exposed to the sun. At night the whole was taken up in mats and put under shelter.

Threshing began two days after by beating the ears with sticks, which causes the grain to drop to the ground. The small amount of broken straw which was on top was gathered by hand, leaving the paddy and chaff below. A first winnowing was done with the "neeru," a tray made of bamboo strips, to separate the grain from the finer pieces of broken straw, and a further winnowing was gone through to separate the light empty grains from the full grains, an operation requiring a great deftness of hand.

The crop taken off the 1/10 acre plot planted amounted to 16⅓ gantangs, which corresponds to a yield of 163 gantangs, weighing 937 lbs. per acre and is much below what might be expected from a trial made under such generally favourable conditions as described above.

But yet, from the first, the writer was under no illusion as to the possibilities of failure of this plot. It might give a satisfactory return—and it might not. An undrained swamp under a semi-aquatic vegetation of "Pandanus" and wild grasses, the land, until it was broken up, constituted an ideal breeding-ground for fungoid and insect pests, and it was a question whether after the thorough tillage (and thereby aëration) which it received, these pests would rally quick enough seriously to injure a crop new to it and a quick crop at that. Certain rotations, as it is well known, are devised on the immunity of certain crops to pests which attack other crops. If the paddy crop had matured, as some races do, in three months, it would have been a bumper crop but even at an early stage, when Mr. Richards, Entomologist to the F. M. S. Agricultural Department, saw it, the crop was already seriously attacked by a grub which he identified as "*Schoenobius bipunctifer,*" a grub frequently found in stems of rice throughout India, and from that time, empty white ears were every day more and more conspicuous throughout the field. This borer belongs to the family of "Pyralidae" which, of all insect pests, is according to Lefroy's "*Indian Insect Life*" one of the most destructive to crops and stored products. The damage is done while in the larval state, it is hidden in the stem and its presence is only revealed when the ear of the paddy is actually dead, no grain being formed for want of the material which has gone to feed the grub.

Added to the toll taken by this pest, the depredations of birds seemed likely at one time to finish the crop. By dint of shouting and empty tin-beating, they were not allowed to have it all their own way, but many ears showed a heavy proportion of emptied husks. It is possible that the damage caused by birds is greater in small isolated spots surrounded, as was the case here, by trees and wild vegetation, where they find immediate shelter (to emerge

again a few minutes later) than on extensive paddy fields, where they have no shelter except by long flights. Be this as it may, they proved to be a most serious cause of loss in the present instance.

The above digression tends to emphasise one point, namely, the necessity of a clean field, especially in the case of so-called "dry" paddy. In the case of "wet" paddy, prolonged immersion under water tends to destroy or to check the breeding of noxious pests living in the ground: this is not the case with *"dry"* paddy which is only partially protected even by the most thorough cultivation. One may, it is true, come across very promising native paddy plots, raised without any cultivation to speak of, on virgin soil newly-cleared of its forest timber, but the case here is very different, for forest land is free from the pests which infest foul grassy plots where *Pyralidae* and *Noctuidae* breed freely.

Reverting to the crop taken from the paddy plot in the Economic Gardens, a test was made with 2 katties of the clean, threshed paddy, after five days' drying. It was made into *"Parboiled"* rice by first steeping the paddy some hours in water, then boiling it for 40 minutes when the husks began to crack, then drying it, and finally husking it with the ordinary mortar and pestle.

The result for 2 kattis (2 lbs., 10 ozs.) was:—

	lbs.	ozs.
Clean rice fit for the the table ..	1	12
Broken rice		$1\frac{1}{4}$
Husk and small broken rice ..		$9\frac{1}{4}$
Fine bran		$\frac{1}{2}$
	2	7

The balance being probably moisture.

The rice, raw, had a pleasant odour and, cooked, an agreeable flavour without the nauseating smell which generally accompanies parboiled rice bought from the shops; smell which is due, most probably, to the steeping of the paddy in water which is rendered foul by the repeated immersions which it is used for.

As already stated, the seed employed in this trial was very mixed and the crop obtained naturally reflected this heterogeneous character. Hence no conclusion can be drawn without further trials, after selection, as to the best variety among the different types harvested, the more so as their destinctive characters, the results possibly of crossings, may not be constant.

The writer is unaware whether investigations have been made in Malaya with a view to the improvement of the local races of rice. Mr. Pasqual's very able pamphlet "Paddy planting in Malaya" has just a few words on the subject. Yet, we read that the relative outturn of paddy per acre in Burma and Malaya is as 13 is to 8, other things being equal, by which is meant, we presume,

equal soil fertility, equal seasonal conditions, equal facilities of irrigation. Thus we may take it that, whereas the Malay wins 150 gantangs, (say), from one acre, the Burmese wins 243 gantangs i.e. 93 gantangs more, or just about enough to feed, under present conditions of shortage, two people for one year.

When we read this, we naturally seek an explanation in one of the two following reasons, or in both:—

No. 1 Faulty cultivation.
,, 2 Poor seed.

The writer lays no claim to expert knowledge in the cultivation of rice, having had but a passing acquaintance with it, until a few months ago. Having, moreover, never been to Burmah, he is unable to compare the two modes of cultivation of the Burmese and the Malays, the only comparison be is able to make is with the little he has seen of it in Java, and in Cochin china, and judging by these standards, he cannot but be of opinion that the Malay paddy planter is the less efficient of the two. Perhaps it is due to the scarcity of buffaloes that the land is less thoroughly puddled, less plowed and rolled; to the scarcity of Kampong population, that the preparation of the land is so scanty, the maintenance of its fertility so little thought of, the embankments so inefficiently made. During a recent trip of the writer through the Malay States, as late as last November, Malays could be seen in the Krian District, still preparing their land for the planting of the paddy crop—that is, if such work as he saw can pass as preparing the land. This consisted in cutting the stubble and rank grasses with the "Tajak" and piling it in straight lines, in squares, actually to form the banks. That stubble which should have gone back to the soil for the sustenance of the crop, was made simply to serve as pathways through the fields. Such treatment of the land not only tends to starve it, but it must also foul it, as these piled up grasses will surely, bye and bye, serve as harbours for rats and vermins, and then what of the crops?

Regarding the amelioration of the seed, that is a matter in which the individual planter can do but little. He may, and does, in countries where husbandry is highly developed, like Japan, obtain by rough methods of selection, a certain degree of uniformity in his crops, but the establishing of improved strains of a permanent character is a work of slow processes, which Governments alone are competent to carry through.

Such work is now being eagerly pursued in regard to wheat in all wheat-growing countries and, now, following the methods of pedigree cultures from single seeds initiated by the Slavof Station in Sweeden, Japan, Java and India have also opened stations for the close study of the cultivation and improvement of rice. High yielding varieties have already been obtained and Buitenzorg was credited, a few years ago, with having raised on its trial fields a variety yielding 76 pickels of rice per bouw ($2\frac{1}{2}$ tons per acre).

As an illustration of the difficulties which confront the plant-breeder in the selection and improvement of rice, the crop now under review affords an instance. The paddy with awns was found after stripping it of its awns to be lighter than the awnless paddy, but, on the other hand, it was 12 to 15 days earlier in ripening, thus combining the very desirable quality of earlier maturity with the twofold drawback of lighter weight and of awns which are a decided disadvantage as, in the sifting with the "neeru," they have a way of sticking fast to the empty grains, thus hindering the proper sorting of the paddy.

Without aiming at such severe and necessarily slow methods, it should be possible for the paddy cultivator, if not always to improve, at least to maintain the quality of his crop, by a system of simple selections, which should commence in the field, by plucking separately a few, say a couple of hundred, of the best panicles, those that present the largest number of spikes with well formed and close-growing grains. If, as in the case here, the crop is a very mixed one, further classification is necessary by separating the samples under their most prominent character of external appearance, such as shape, colour of the glumes, colour of the awns, and absence of awns. If the ears taken off the field present a general appearance of uniformity, the grain should be picked off the upper third of the ears, and amongst those grains the heaviest and brightest coloured should be selected for seed for the future crop. There is not a doubt that the grains on the top part of the ear are the best and heaviest. The writer has made several comparative weighings of grains taken from the lower half of the panicles, and of grains from the top, and, for an equal number of grains, the difference of weight has always been in favour of the upper grains; in one case, 100 full grains of the upper part of the panicle weighed as much as 156 full grains of the lower part. This difference is observed in husked as well as in the unhusked grain. Having proceeded so far in his selection the cultivator may immerse his seed in water and throw out any grain which floats, thus eliminating all weaker and damaged seed: lastly, following the Japanese method, he can drop the seeds in salt solutions of varying strengths—thus securing, for sowing, the denser seeds which are generally found to germinate and ripen quicker.

Instead of sowing his seeds straight away in the nursery, they can be previously made to germinate under wet gunny bags, and sown after germination. Here again selection can take place to some extent.

In the writer's opinion the trend of selection should be, after weight of grain and early maturing grain, from the awned to awnless, and from dark-coloured rice to white, but of course, the cultivator knows best where his interest lies, and it is up to him to answer the demand of his market.

E. Mathieu.

Notes on Hevea confusa Hemsl.

In Vol. II No. 4 of the "Gardens Bulletin" a description was given of *Hevea confusa* which is considered to be an undesirable neighbour to *Hevea brasilensis,* although in general appearance it is not easy to tell them apart. In reference to the above article the following letter has been received from Prof. J. B. Harrison, C.M.G., Director of Agriculture, Demerara. It would appear that the plants at Singapore were raised from Prof. Harrison's seeds. "Your records will show you that about 1910-1911 I wrote to your gardens seeking information about the seeds of *Hevea confusa* sent there from here about 1898-1900. Will you kindly inform Mr. B. J. Eaton that his analytical results on the rubber fully confirm those obtained here about 1910-1911 during the large scale tappings of *H. confusa* trees in our forests. We showed the *confusa* rubber at the Rubber Exhibition of 1911. When the soft rubber is kept for a length of time it very slowly gains resiliency and finally resembles slightly tacky or very inferior rubber from *H. brasiliensis.* Towards the end of 1910 the *H. confusa* rubber was valued in the U. S. A. at approximately 66% of the then price of hard para rubber. Some hundreds of pounds were said to have been used in the factory tests. It was I believe, finally used as an ingredient in mixings for vulcanite.

"*H. confusa* has proved to be a most objectionable tree. Experience has shown that cross-fertilisation between *H. confusa* and *H. brasiliensis* readily takes place but, worst of all it appears in the Guianas to be the forestral host plant of the organism giving rise to the leaf-disease of Para rubber, which disease has practically put an end to the chances of successful Para rubber cultivation in French and British Guiana."

A small seedling has been planted in the Botanic Gardens near the Herbarium and far removed from any *Hevea brasiliensis.*

T. F. C.

A Pest of Lima Beans.

A beetle which has been very troublesome in eating the leaves of the Lima Bean plants was submitted to the Rev. G. Dexter Allen for determination. In his reply Mr. Dexter Allen says:—

"The insects you sent are Phytophagous beetles of the Section Eupoda and almost certainly, belong to the Genus Cryptocephalus, the species is very probably un-named as yet. The genus has very numerous representatives in the Indo-Malayan Insect Fauna, and this is about the smallest species of the genus I have seen. These beetles generally feed on the leaves at night and are therefore difficult to exterminate. I have often collected Phytophagous beetles, never so small as these however, with some one carrying a hurricane lamp for me. Spraying the leaves is frequently useful, nicotine and arseniate of soda might be tried experimentally."

T. F. C.

On the Pollen of Carica Papaya.

The following notes on the flowers of the Papaya (Carica papaya) are compiled from the observations of some plants grown in the Economic Gardens, Singapore.

An examination of the pollen of different types of flowers showed a considerable difference in the germination of the pollen grains but unfortunately, owing to thefts of fruit the ultimate results of the work could not be observed.

Pollen from four different types of flowers was examined. 1. Flowers with ten stamens from dioecious plants. 2. Flowers with ten stamens from plants bearing both male and hermaphrodite flowers. 3. Flowers with five stamens from hermaphrodite plants. 4. Flowers with ten stamens from hermaphrodite plants. Flowers with the number of stamens varying between five and ten were omitted.

In all cases the pollen grains appeared to be identical. When dry the germ spore is not visible but when the grain has been soaked in water it swells up, becomes turgid, and the germ spore can be distinctly seen.

To ascertain if there was any difference in the time taken for the pollen from the four different types of flowers to germinate, pollen grains were cultivated in a sucrose gelatine medium in a hanging drop culture.

In the first experiment pollen from the first and second types of flowers mentioned above behaved practically the same, all the grains germinating and growing well. Similarly the pollen from the third and fourth types of flowers behaved almost identically but they both germinated several hours later than those of the first two types.

A second experiment was conducted using pollen from the first two types of flowers only, when it was found that pollen of the first type germinated half an hour before that of the second type.

The deductions to be drawn from these records so far as they effect pollination are not at present quite evident, and require further observations to be carried out.

G. B. Deshmukh.

Some Trials of Food-plants in the Economic Gardens, Singapore.

Ragi ("Eleusine Coracana")

In the *Singapore Free Press* of 23rd October, will be found a short account of this plot, of the method of cultivation followed, and an estimate of the yield of seed expected.

Briefly, this plot of 3980 square feet or say, one eleventh part of one acre, was stocked with 2675 seedlings transplanted on the 20th July from a nursery sown on the 29th June, The plot was divided into 18 beds, and the planting was all done on these raised beds at 12 by 12 inches.

An estimate made on October 5th put the expected crop at 20,000 panicles yielding 177 lbs. of clean dry seed.

The last gathering has now taken place and the result of the crop is shown by the following figures:

Dates of picking.	Number of panicles.	lbs.	ozs.
28th September	218	2	—
1st October	360	3	15
6th ,,	880	7	11
9th ,,	1030	8	8
12th ,,	not counted	4	2½
16th ,,	430	2	—
20th ,,	970	10	8½
26th ,,	4000	48	—
3rd November	10000	80	—
10th ,,	7000	17	—
Totals	24888	183	13

Thus the crop of one eleventh of one acre totalled 183 lbs. 13 ozs. of clean dry ragi ready for grinding, equivalent to 2000 lbs. or 300 gantangs per acre.

It is probable judging from the number of panicles collected, which is far in excess of the estimate previously made, that the crop would have been greater but for the depredations caused by birds. Although a boy was employed lustily beating a kerosine tin, it is feared that the toll taken on Sundays and holidays was somewhat considerable, as is shown by the short weight of the last picking of 10th November, which for 7000 panicles only gave 17 lbs. of clean seed—a great number of panicles being found empty of seed. The crop was sold at 7 cents per lb. realising $12.80 which is equivalent to a gross return of $140.80 per acre.

From the date of sowing the seed in the nursery on 29th June, to the last picking, the crop had occupied the ground for 4 months and 12 days .

The piece of land on which this trial was made is very low, rather wet and liable to floods, with a loose friable and deep soil, quite suitable to the cultivation of ragi if it could be properly drained. Fortunately no flood occurred to spoil the crop, and the weather was moreover propitious throughout, except just towards the end when excessive rains may possibly have delayed the ripening of the grain, affecting thereby the colour of the seed which lacked the brilliant orange tint of the previous lots.

Except the changkoling of the land and the making and raking of beds, the work, from the transplanting of the seedlings to the harvesting of the crop and the de-husking of the grains, was almost wholly performed by women, who seem to take to this work with the zest which attaches to the familiar tasks of farm life.

The gathered crop was treated in the following way. The panicles, cut close to the base of the spikelets, were brought in in baskets and put in heaps of ten, then in heaps of 100 to get an exact count of the crop. The whole day's gathering was then exposed to the sun on a concrete floor and after a few hours drying, the whole was trodden under with the feet, the right foot being now and again used in a twisting motion to tear the spikelets asunder. The result was a mixture of husks, of nerves of panicles, and of grain which was then taken up on trays, the ordinary "neerus" of the country—and there, after three circular motions and a final jerk upward, the seed, absolutely clean, was dropped in a basket in front, the remaining waste being thrown aside. This work requires great deftness of hand and tamil women excel at it.

E. Mathieu.

(To be continued.)

Coconut Bud Rot.

The Philippine Journal of Science Vol: XIV, No. 1, January, 1919 contains a valuable addition to our knowledge of the disease known as "bud rot" which causes such severe losses of coconut trees throughout the tropics. Mr. Otto A. Reinking after giving a short history of the symptoms of the disease gives in detail his investigations both in the laboratory and the field. In his conclusions he states that the actual cause of the disease is a fungus *Phytophthora Faberi* Maubl. which in the majority of cases is quickly followed by bacteria which rapidly destroy the weakened tissues, causing the familiar rot.

As the fungus is the same that attacks coconut seedlings, cacao fruit, Hevea rubber seedlings, and papaya fruit, and as it is impossible to cure trees badly infected he gives the following instructions:—

1. Systematic inspection, condemning and burning of all diseased coconut trees.

2. All parts of diseased trees must be burned, otherwise the organism will live as a saprophyte on dead matter, and then spread to healthy trees.

3. Clean cultivation ought to be practised in all groves.

4. Under no circumstances should coconuts be interplanted with cacao or papayas.

5. If coconuts are planted near diseased Hevea rubber, precautions should be taken to avoid the spread of the disease.

6. Trees in new groves must be planted 10 meters apart each way. This spacing is one of the most satisfactory means of control against bud rot, and at the same time tends to give the highest production of nuts.

T. F. C.

Reviews of Local Publications.

From a perusal of the recent publications of the Scientific departments of the surrounding countries one is struck with a noticeable change in the type of article now appearing. Hitherto one has had the preliminary records and interim reports of the pioneer who tackled any subject that from time to time assumed economical importance. Now one sees on all sides attempts to sum up the information so far gathered and published piecemeal and the result is a series of comprehensive papers, one might almost say monographs, which are now appearing and which deal exhaustively so far as our knowledge up to date goes of whole subjects rather than isolated and unconnected items. It would seem that the first period of preliminary investigation of the poineer who was an all round scientific and technical man has closed and that in future the specialists who have been arriving in these parts in recent years will each conduct his investigations heneceforth in a much more restricted field but correspondingly probing into his subject all the more deeply.

In illustration of these comprehensive articles referred to the following are representative.

Plantes et produits filamenteux et textiles de l'Indochine. Crevost et Lemasie. Bulletin Economique de l'Indochine, 1919, No. 138. A brief description is given of each plant and the manner in which the fibre is obtained. The plants are arranged according to their Natural Orders. The article is illustrated by fifteen wood cuts which greatly facilitate the determination of the plants, and five photographs shewing plantations and the preparation of fibres.

Studies of Philippine Bananas. E. Q. y Arguelles. The Philippine Agricultural Review Vol. XII, No. 3. This is a comprehensive study of the varieties of bananas in cultivation in the Philippines. It is estimated that the College of Agricultural has over 600 varieties under culture and about one third of them have been definitely identified. A key is given which enables these varieties to be recognised, and is followed by descriptions of varieties of *Musa sapientum.* Thirty four plates are given at the conclusion of the article which enables one readily to distinguish the differences between the different kinds of flowers and fruits.

A biological and systematic study of Philippine Plant Galls. L. B. Uichanco. The Philippine Journal of Science Vol. XIV No. 5. This subject has been treated in a series of articles on Javanese, Sumatran and Celebes galls by W. and J. Docters Van Leenwen-Reijanvaan of Buitenzorg, but the present article on the Philippine galls is in English and therefore much more accessible to residents of Malay.

The galls and their causative insect agents are described in detail and the fifteen plates accompanying the article greatly assist in their identification.

Bamboos. To anyone interested in bamboos the handbook on this subject by Brown and Fischer issued as Bulletin No. 15 of the Philippine Bureau of Forestry is a most useful work. A key is given by which the species can be determined in the field from general observation and without entering into minute detail. General descriptions of the species are given, cultural notes and the results of observations of the plant grown in plantations. Thirty three photographic plates shewing the characteristics of the species individually and in plantations increases the value of the work.

Philippine Mangrove Swamps. W. H. Brown and A. F. Fischer. Bulletin No. 7 of the Bureau of Foestry of the Philippines is devoted to an account of Mangrove swamps. A list of species to be found in the swamps is given and a special key based on superficial characters which enables one to ascertain the name of anything down to a fern. Although primararily a study in the Philippines, Malay native names are included which greatly enhances its value to us in Malaya. A general description is given of each species and the cultivation of mangrove forests and their estimated yield of timber is recorded. Its economical uses are considered both as a firewood and as a tanbark and dye. A chapter is devoted to the uses and cultivation of the Nipa Palm. The whole booklet is lavishly illustrated by photographs and forms a valuable addition to the handbooks of special ecological formations of this part of the world.

Fruit Culture in Malaya. J. N. Milsum. The F. M. S. Department of Agriculture, Bulletin No. 29. This book bringing together our knowledge of local fruit trees and their cultivation has long been needed, and the want is supplied in the present publication. The author begins with a discussion of the past and present position of fruit cultivation and then suggests lines on which local fruits can be improved. General methods of cultivation are given and discussion on soil and diseases.

The article concludes with descriptions of fruit trees according to their general utility, and suitable localities. Twenty three excellent photographs of fruits and trees are included in the work.

Food Production in Malaya. F. G. Spring and J. N. Milsum. F. M. S. Department of Agriculture Bulletin No. 30. This is a companion volume to the preceeding and treats of the cultivation of food crops in general from all points of view.

T. F. C.

RAINFALL at the Director's house, Botanic Gardens, Singapore during the first half of the year 1919, in inches.
Readings taken always at 8 a. m. and credited to the date in which the twenty-four hours begin.

Date.	Jan.	Feb.	March.	April.	May.	June.
1	trace.	.12	nil.	nil.	.04	.52
2	.09	nil.	.09	.14	nil.	.44
3	3.99	nil.	1.42	.60	.23	.99
4	.06	trace.	1.04	.06	trace.	.24
5	.17	nil	.22	.23	nil.	.02
6	.29	nil.	trace	nil.	nil.	.02
7	.09	.13	trace	nil.	.35	trace.
8	.18	1.04	2.08	.18	.44	.49
9	05	.07	.09	.06	1.68	.01
10	.09	nil.	.40	.29	trace.	nil.
11	2.06	nil.	.02	1.15	.32	.02
12	1.46	nil.	trace.	1.03	.01	nil.
13	.29	.21	nil.	nil.	.01	.81
14	nil.	nil.	nil.	nil.	nil.	.01
15	nil.	.72	.02	.03	.02	.01
16	nil.	.27	.26	.02	nil.	nil.
17	.01	nil.	nil.	.02	.01	trace.
18	.19	nil.	nil.	.12	.52	nil.
19	.03	.16	nil.	.55	1.09	nil.
20	1.21	.33	trace	.03	.03	trace.
21	.10	nil.	.20	.17	nil.	nil.
22	.01	.63	.02	.77	.15	nil.
23	.36	.59	trace.	.04	.50	trace.
24	.41	.02	.96	nil.	.15	.16
25	trace.	nil.	.26	nil.	1.24	nil.
26	1.16	.34	.04	1.47	.03	trace.
27	.74	.03	trace.	.33	.01	.54
28	.78	.08	1.26	nil.	1.13	.04
29	trace.	...	.96	trace.	.48	trace.
30	.67	...	nil.	.03	.03	.01
31	.83	...	.58	...	nil.	...
	15.32	4.74	9.92	7.32	8.47	4.33

RAINFALL at the Director's house, Botanic Gardens Singapore during the second half of the year 1919, in inches, Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.01	2.01	trace.	.02	.40	.01
2	nil.	.50	.13	.45	trace.	.26
3	nil.	.01	nil.	.35	.65	.29
4	nil.	nil.	.43	.45	.27	.03
5	.04	nil.	trace.	.60	.14	nil.
6	trace.	nil.	nil.	.20	trace.	nil.
7	.02	nil.	nil.	1.00	.10	1.20
8	.12	.04	nil.	.36	1.35	.67
9	2.20	nil.	nil.	1.35	.24	.26
10	.01	trace.	nil.	.11	trace.	nil.
11	.02	.36	.18	1.67	.25	.86
12	.01	trace.	.02	trace.	nil.	.28
13	.02	.05	trace.	nil.	.95	.19
14	.42	nil.	trace.	nil.	trace.	trace.
15	.02	nil.	.03	nil.	.47	.19
16	.01	2 38	nil.	nil.	trace.	.02
17	trace.	nil.	nil.	trace.	trace.	nil.
18	.15	trace.	nil.	nil.	.06	trace.
19	.38	.03	nil.	1.40	nil.	.30
20	.21	nil.	trace.	.01	.18	.33
21	2.05	.06	.05	.01	.77	trace.
22	.15	nil.	.86	.07	.06	1.63
23	2.07	.90	trace.	trace.	trace.	1.25
24	.21	nil.	.02	nil.	.05	.39
25	nil.	nil.	2.70	.20	.02	.15
26	nil.	nil.	.15	nil.	.43	.02
27	nil.	.08	nil.	.85	.01	.01
28	nil.	.05	.07	.04	nil.	.08
29	nil.	nil.	.09	trace.	.73	.18
30	nil.	nil.	.09	trace.	.62	.02
31	nil.	.15	...	1 80	.01	.13
	8 12	6.62	4.82	10.94	7.76	8.75

RAINFALL at the head of the Waterfall Gardens, Penang during the first half of the year 1919, in inches.

Reading taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Data kindly supplied by the Municipal Commissioners of George Town, Penang.

Date.	Jan	Feb.	Mar.	Apr.	May.	June.
1	...	...	...	...	.25	...
2	...	...	...	.95	...	...
3	...	...	...	...	.42	1.30
4	.08	...	...	.66	1.85	.12
5	...	...	...	...	.19	...
6	.20	...	...	.85	...	...
7	.86	...	...	.25	...	...
8	.03	...	.09	.05	.05	...
9	...	...	.13	...	.30	...
10	.04	.53	...	...	1 84	...
11	...	...	...	.30	.03	...
12	...	...	...	1.75	.34	...
13	.24	...	...	...	...	.18
14	...	...	1.28	...	.26	...
15	...	.14	..	.03	.22	...
16	...	...	.06	.07	.03	...
17	...	...	...	.61	.25	..
18	...	1.16	...	.03	. .	...
19	.25	...	...	.17	...	...
20	.55	...	...	.32	.19	.33
21	...	...	...	.03	.17	.18
22	...	1.85	.31	...	...	...
23	...	...	.07	1.85	.62	...
24	.07	...	1.13	.55	.08	...
25	...	...	...	.03	...	...
26	.42	...	.83	...	.61	.37
27	...	...	.05	...	.88	1.20
28	.22	...	.03	.05	1.95	.27
29	...	...	1.77	...	.83	.12
30	...	...	.05	...	.09	...
31	...	...	1.05	1.78	...	...
	2.96	3.68	6.85	10.33	11.45	4.07

RAINFALL at the head of the Waterfall Gardens, Penang during the second half of the year 1919, in inches.

Reading taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Data kindly supplied by the Municipal Commissioners of George Town, Penang.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	...	...	...	.88	.04	.03
2	.08	.50	.10	1.10	.22	.30
3	...	.42	...	1.05	.05	.15
4	...	...	...	...	...	...
5	.24	.77	.34	1.76	.24	.20
6	...	.23	.05	.63	...	.34
7	.85	.43	.09	.64	.63	...
8	.09	.06	...	1.88	.63	.24
9	...	.20	...	.80	.58	...
10	1.23	...	.85	.53	.17	...
11	.78	...	.31	1.53	.03	.10
12	...	...	1.15	.20	.29	...
13	.07	...	.54	.07	.03	.
14	...	.32	3.12	...	...	...
15	.12	.20	.10	.80	.79	1.33
16	.05	.56	.75	...	.03	.56
17	.55	...	...	...	...	.13
18	...	...	...	...	.30	...
19	...	...	.58	...	.12	.03
20	.03	.03	1.58	...	1.45	.56
21	.32	...	.03	...	.03	.15
22	.74	...	.15	...	.48	.07
23	...	...	.60	.24	...	...
24	.67	.29	.20	...	.53	...
25	.44	.10	.07	.17	.14	.12
26	...	.03	.32	.23	.03	1.69
27	...	.18	.14	.09	.07	...
28	...	.06	.03	1 07	.12	.57
29	...	.03	...	.35	1.15	.45
30	...	...	...	...	...	...
31	...	...	...	...	...	...
	6.26	4.41	11.10	14.02	8.15	7.02

SUMMARY OF RAINFALL FOR 1919.

	SINGAPORE.		PENANG.	
	No. of rainy days.	Longest spell without rain.	No. of rainy days.	Longest spell without rain.
January - - -	25	3	11	5
February -	15	3	4	9
March - -	18	3	13	7
April - - -	21	2	19	2
May - - -	22	2	22	2
June - - -	16	2	9	8
July - - -	19	7	15	6
August - - -	13	4	17	4
September - -	13	5	21	2
October - - -	19	4	19	7
November - -	21	1	24	1
December - -	24	2	18	3

	Singapore	Penang
Greatest amount in 24 hours ...	3.99 in	3.12 in.
,, ,, 48 ,, ..	4.08 in.	3.66 in.
,, ,, 72 ,, ...	4.27 in.	4.81 in.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. II. Issued January, 7th 1921. Nos 9, 10 and 11.

A LIST OF THE FUNGI OF THE MALAY PENINSULA.

I. *The object of this List.*

The Flowering Plants of Malaya have already received considerable attention, partly from the fact that they are easy to study and collect owing to their size, and partly that they early assumed importance from their economic value. The results of these investigations have been published from time to time, and a general view of the whole embodied in the "Materials for a Flora of the Malay Peninsula." "The Flora of the Malay Peninsula" itself, which will provide the standard work on systematic Phanerogams, is now in the press.

The remainder of the flora, consisting of the Ferns, Fern Allies, Mosses, Algae, Lichens and Fungi has not yet been considered in any co-ordinated work. With the investigation of this branch in view a special appointment was made to the Staff of the Botanic Gardens, Singapore, in 1914, but owing to the war the post was not taken up till 1919. Work was then immediately begun on the Fungi as they were considered to be of most economic importance. The original intention was to publish "Materials" from time to time, and not to bring out any general work until sufficient investigations had been carried out for the production of a standard publication. Owing to an unexpected change of staff, however, and the fact that an interval will elapse before the post can again be filled, it was felt that the work of the past eighteen months ought to be co-ordinated and put on record rather than a risk be run of its being lost and having to be done over again.

The present work is, therefore, a compilation only, and is a bringing-together of all the information to which access has been obtained relating to the Fungi and Fungus literature of the Malay Peninsula. Time alone has not permitted the extension of these investigations to the other Cryptogams.

In this enumeration no attempt has been made to discuss the merits of the various species to which collections have been assigned, nor has it been possible, owing to the work having been carried out

in Singapore, to check the earlier determinations or to determine a considerable amount of the material that is available in the Botanic Gardens' Herbarium. It is unavoidable, therefore, that many specific names are quoted separately that are now established synonyms, as the only resource in the present case was to enter each record, and leave amalgamations and reductions to a later work.

Owing to the difficulty of keeping herbarium specimens in the tropics the collections made before 1912 were sent to Kew, and only a small amount of named material was accumulated, therefore, for comparison at Singapore. Cryptogamic works of reference were also few as it was not possible or advisable to purchase the standard works on this subject which contain only the briefest and occasional references to the fungi of this country, and which are now at a very high price. As access to them is only possible in the large scientific libraries of Europe and America, the original intention was to delay any treatise on the whole of the Malayan Fungi until a visit to Europe should enable these shortcomings to be remedied.

II. *Our knowledge of Malayan Fungi.*

Until some few years ago our knowledge of tropical fungi was exceedingly small, and it was generally considered that the fleshy and more evanescent types were but poorly represented. This no doubt was due to the fact that collectors brought back to Europe only the harder and more durable kinds as they were unable to attempt to preserve the others. More recent researches show that these views were quite incorrect. Whilst the larger and harder fungi such as the Polyporaceae are everywhere in evidence it is soon seen that there is an immense variety of the more perishable kinds whose fructifications appear periodically and last but a few days. The only way these can be adequately recorded is by coloured sketches made from fresh material on the spot. An initial collection of such drawings has already been made at Singapore by De Alwis and Mrs. Burkill, and it is hoped that their publication will shortly be undertaken.

The following paragraphs give a general review of our present knowledge of the groups of Malayan fungi.

Work on the Myxomycetes is all recent. At the present moment Mr. A. R. Sanderson is preparing a monograph on the Malayan species and such as are cited in this work, therefore, are only those that are represented at Singapore. In view of Mr. Sanderson's entensive research it was felt better to leave the detailed account of them for his coming publication. The determinations were made by Miss Gulielma Lister to whom our thanks are due, and at Kew.

Our knowledge of the Phycomycetes is at present very small, entirely owing to lack of investigators in this branch. It is certain that these fungi are abundant and also that they are of considerable economic importance, as the work already done on Phytophthora, for instance, shows. At the present moment there is but very little completed work to be chronicled for this country.

The Ascomycetes have received rather more attention, but chiefly of recent years. Species of outstanding economic importance have been dealt with individually by different Malayan mycologists, but the largest additions to our collections are due to Professor C. F. Baker who served on the Staff of the Botanic Gardens, Singapore, in the year 1917.

The Basidiomycetes, except for the Agaricaceae form far and away the bulk of our collections. Our earliest records are specimens collected by Beccari between 1865 and 1879 apparently on his way to Sarawak, and by the Rev. Father Scortechini in 1885. Kunstler, a collector of Sir Geo. King of Calcutta, was also one of the earlier collectors, whilst a large number of all groups have been collected by Mr. Ridley. The largest local fungus of which we have a record, belongs to this section and is a specimen of Polyporus applanatus, with a diameter of 43 cm. and a thickness of 13 cm. To Mr. C. G. Lloyd our thanks are greatly due for his very kind assistance in determining the many specimens of the Basidiomycetes submitted to him.

The majority of our collections of Agaricaceae are due to Mr. H. N. Ridley and Mrs. Burkill. It is evident that they will prove to be as widely represented as any section of fungi when once the study of them can be carried out on the spot with fresh material.

Our records of the Fungi Imperfecti are again chiefly due to the collections of Prof. C. F. Baker. The study of this section, many of the species of which are of economic importance, has only been undertaken so far in individual cases, but with the provision of laboratories and scientific apparatus now being made investigations should go quickly ahead.

It is interesting to note the general habitats favoured by the various groups of fungi. The Myxomycetes appear as saprophytes generally on dead wood and similar matter. The Phycomycetes, so far as our scanty knowledge goes at present, are both parasitic and saprophytic, and provide the all-prevalent "mildews." The Ascomycetes are also both saprophytic and parasitic, and are responsible for a good deal of damage especially on trees and woody plants. The Rusts and Smuts so far appear but poorly represented, possibly owing to the absence of any large tracts of land in this country under cereal crops. The Basidiomycetes with the exception of the Agaricaceae and subsequent groups are nearly always to be found on a woody stratum, and although the fructifications appear most frequently on dead wood, it should by no means be taken that they are saprophytic. Indeed many of our worst diseases of the rubber plantations are due to this group. The Agaricaceae, Phallaceae, etc. are generally found on the ground. The Fungi Imperfecti, generally favour the same types of hosts as the Ascomycetes.

III. *The perservation of Fungi in the Tropics.*

A word may here be said on the preservation of herbarium specimens in the tropics as this has proved such a source of trouble in the past. It appears essential that when collecting fungi one

must be able to return to one's base every night. Specimens collected on one day's march cannot be preserved and carried on as in the case of flowering plants, with the exception of course of the hard woody kinds, as the characters must be worked out whilst they are fresh and the fructifications rarely last over twenty four hours. Fungi growing on leaves and of a similar nature can be put into an ordinary press, but for all others it was found advisable to collect them in baskets, wrapping each collection loosely in a sheet of paper and placing them on top of each other in the baskets.

On arrival at camp a certain number such as those of a leathery or fibrous nature may be sun dried, but the fleshy ones should be soaked in spirit for about five minutes. If they are fragile or it is essential to preserve their shape, and they are of a nature to allow this to be done, they may then be dried off in a press. Others such as thick or caespitose specimens should be dried off gradually in a hot air oven and preserved in boxes.

Before being put away all specimens must be poisoned, but the proportion of corrosive sublimate must not be such that it will form a deposit on the specimen and block the pores. In the herbarium cabinets balls of naphthalene should be placed on the shelves and in the boxes, and a little powdered naphthalene between the sheets.

Even with all these precautions it has been found necessary to go over all the specimens every two or three months and poison again where necessary.

In dealing with the Agaricaceae the experiment was tried of obtaining the spore cast on a glass slide, and so far this has proved very satisfactory. It enables the spores to be examined by reflected and transmitted light, and if the slides are kept in a slide cabinet they are handy for future reference and comparison. It is necessary, however, from time to time to examine them and when any growth of mycelium is observed to wash the slide over with alcohol.

IV. *The present work.*

The arrangement followed in the present compilation is that of Engler's "Die Pflanzenfamilien," except in the case of the Myxomycetes where Arthur Lister's arrangement has been adopted. Species are arranged alphabetically. The area dealt with includes the Straits Settlements, and the Federated and neighbouring Malay States.

The only works of reference cited in the text are those of Malayan publications which are available for local consultation. It was considered quite unnecessary to burden the work with complete lists of references or citations from European and world-wide standard works, the idea being to frame the pamphlet on the type of a local flora.

In the bibliography at the end the works quoted are those referring especially to Malayan Fungi. It is interesting to note that, apart from lists of determinations of collections such as those published by M. C. Cooke in Grevillea, there is, so far as can be

found, only one previous attempt to list Malayan Fungi. This was by Bancroft in 1913, where (in the Agric. Bull. F. M. S. i. p. 259) he gives a "List of Fungi identified in the Federated Malay States, with notes on their occurrence." One hundred and five species are mentioned, including Cooke's list of determinations of the collections forwarded by Sir George King. Later in the same year Sharples published "Additions to the Mycologic Flora of Malaya," (Agric. Bull. F. M. S. ii. p. 83.), where he lists five more species. No attempt has been made to add up the number of species mentioned in the present work, as many synonyms are evident, and the early determinations need checking.

In the accompanying enumeration the specimens numbered above 4000 have been collected by the staff of the Botanic Gardens, Singapore since the special appointment, mentioned on p. 311, was taken up. Professor Baker's collections and those of other individuals can be ascertained from the collector's name given.

The work of the Mycologists of the Agricultural Department, F. M. S., and those independently engaged in this work in the country is evident from the copious quotations, throughout the accompanying pages. It is hoped that this present compilation will be of assistance to local mycologists engaged upon the biology of fungi that from time to time assume predominant economic importance, as well as to future workers on the systematic study of Malayan fungi.

Acknowledgement must be made of the copious notes made by Mr. Ridley during his long sojourn in Malay and which he has very kindly allowed to be incorporated in this work.

Thanks are due also to the Director of the Royal Botanic Gardens, Kew, and Miss Wakefield, for their welcome assistance in determining specimens and supplying information on many difficult points.

I am greatly indebted to Mr. I. H. Burkill, Director of the Botanic Gardens, Singapore, for the many facilities and assistance he has given me in the course of my investigations.

T. F. Chipp.

Abbreviations.

The following abbreviations have been used for citations in the body of the work:—

Agric. Bull. Mal. Penin.	Agricultural Bulletin of the Malay Peninsula.
Agric. Bull. S. and F. M. S.	Agricultural Bulletin of the Straits and Federated Malay States.
Gard. Bull. S. S.	The Gardens' Bulletin, Straits Settlements.
Agric. Bull. F. M. S.	The Agricultural Bulletin of the Federated Malay States.
Dep. Agric. F. M. S. Bull.	Department of Agriculture, Federated Malay States, Bulletin.
Journ. F. M. S. Museums	Journal of the Federated Malay States Museums.

MYXOMYCETES.

CERATIOMYXACEAE.

CERATIOMYXA FRUTICULOSA, Macbr.

VAR. FLEXUOSA, Lister.

Distr:—Singapore, Botanic Gardens, *Sappan,* 5105. Economic Gardens, *Chipp,* 4832, 5750.

Appearing as small white tufted patches on dead logs.

PHYSARACEAE.

PHYSARUM COMPRESSUM, Alb. and Schw.

Distr:—Singapore, Botanic Gardens, on a dead log, white when fresh drying grey, *M. Noor,* 5059.

PHYSARUM NUCLEATUM, Rex.

Distr:—Singapore, Tampinis Road, on a trunk of Cocos nucifera, *Burkill,* 269.

PHYSARUM NUTANS, Pers.

Distr:—Singapore, Economic Garden, January 1916, *Burkill,* A 48.

PHYSARUM VIRIDE, Pers.

Distr:—Singapore, Woodlands, on dead wood, *M. Noor,* 5376. Economic Garden, on a dead branch of Treculia africana, *A. Kadir,* 5793; on a dead branch of Hevea brasiliensis, *Chipp,* 5851.

TRICHAMPHORA PEZIZOIDES, Jungh.

Distr:—Singapore, Botanic Gardens, on a heap of brushwood, Oct. 1915, *Burkill.*

PHYSARELLA OBLONGA, Morg.

Distr:—Singapore, Botanic Gardens, on bark, *M. Noor,* 5132, 5133.

DIACHAEA ELEGANS, Fries.

Distr:—Singapore, Botanic Gardens, on dead stems of Acalypha, *Ridley.*

DIDYMIACEAE.

DIDYMIUM LEONINUM, Berk. and Br.

Distr:—Singapore, Botanic Gardens, on leaves, Nov. 1913, *Burkill.*

STEMONITACEAE.

STEMONITIS FUSCA, Roth.

Distr:—Singapore, Botanic Gardens, on a stump of Cyrtophyllum, July 1917, *Burkill;* on a dead log, *Burkill,* 5529. Economic Garden, on a stump of Hevea brasiliensis, Sept. 1915, *Burkill;* on a dead log, *Kiah,* 5730.

STEMONITIS HERBATICA, Peck.

Distr:—Singapore, Botanic Gardens, on a dead log, *Sappan,* 5139.

STEMONITIS SPLENDENS, Rost.

F. FENESTRATA.

Distr:—Singapore, Botanic Gardens, on a stump of Albizzia, Aug. 1914, *Burkill.*

COMATRICHA LONGA, Peck.

Distr:—Singapore, Botanic Gardens, on a dead log, *Sappan,* 5103.

COMATRICHA PULCHELLA, Rost.

Distr:—Singapore, Botanic Gardens, Nov. 1913, *Burkill.*

COMATRICHA TYPHOIDES, Rost.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5613. Singapore, Botanic Gardens, on a dead log, *M. Noor,* 5060.

HETERODERMACEAE.

CRIBRARIA SPLENDENS, Pers.

Distr:—Singapore, Woodlands, on dead wood, *Sappan,* 5413.

TUBULINACEAE.

TUBIFERA FERRUGINOSA, Gmeln.

Distr:—Singapore, Woodlands, on soil, *Sappan,* 5396.

TUBIFERA STIPITATA, Macbr.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan,* 5108.

LYCOGALACEAE.

LYCOGALA EPIDENDRUM, Rost.

Distr:—Singapore, Woodlands, on dead wood, *Sappan,* 5412. Botanic Gardens, *Ridley,* 16.

LYCOGALA MINUTUM, Sacc. and Paol.

Distr:—Without precise locality, on fallen dead twigs, *Scortechini,* 511.

ARCYRIACEAE.

ARCYRIA DENUDATA, Sheldon.

Distr:—Singapore, Botanic Gardens, on moss, *Sappan,* 5141. Economic Garden, on a rotten stump of Hevea brasiliensis. Nov. 1916, *Burkill.*

ARCYRIA NUTANS, Grev.

Distr:—Singapore, Economic Garden, on a dead log, *Chipp,* 4842.

ARCYRIA OERSTEDTII, Rost.

Distr:—Singapore, Economic Garden, on a dead log, *Chipp,* 4850.

ARCYRIA PUNICEA, Pers.

Distr:—Singapore, Botanic Gardens, on dead wood, *Ridley.* Without precise locality, on dead branches, *Scortechini,* 154.

PHYCOMYCETES.

PERONOSPORACEAE.

PHYTOPHTHORA FABERI, Maub. Pratt. in Agric. Bull. F. M. S. v. 180. Chipp, in Gard. Bull. S. S. ii. 189.

Recorded as a bark disease of Hevea brasiliensis.

PHYTOPHTHORA sp. Richards, in Agric. Bull. F. M. S. v. 312.

Recorded as a cause of canker of Hevea brasiliensis.

ENTOMOPHORACEAE.

ENTOMOPHORA sp.

Distr:—Singapore, Botanic Gardens, on a Calliphora fly, Feb. 1917, *Burkill,* A47.

ASCOMYCETES.

MONASCACEAE.

MONASCUS HETEROSPORUS, Schr. Bancroft, in Agric. Bull. F. M. S. i. 259; and in Dep. Agric. F. M. S. Bull. Nos. 16 and 19. Chipp, in Gard. Bull. S. S. ii. 191.

Recorded as causing a spotting on prepared rubber.

GEOGLOSSACEAE.

GEOGLOSSUM HIRSUTUM, Cke.

Distr:—Singapore, Botanic Gardens, *Ridley.*

GEOGLOSSUM SPATHULATUM, Massee.

Distr:—Singapore, on the ground, *Ridley.*

PEZIZACEAE.

PEZIZA ALUTICOLOR, Berk.

Distr:—Without precise locality, on bark, *Scortechini*, 116

PEZIZA CROCINA, Mont.

Distr:—Singapore, 1865, *Beccari.*

PEZIZA EPISPARTIA, Berk. and Br.

Recorded from a collection by *Burkill.*

PEZIZA MARTIALIS, Massee.

Distr:—Selangor, on the ground, *Ridley,* 48.

PEZIZA RADICULOSA, Berk. and Br.

Distr:—Perak, on the ground, *Ridley,* 12.

PEZIZA RUTILANS, Fries.

Distr:—Perak, *King's collector.*

PEZIZA TOMENTOSA, Massee.

Distr:—Selangor, on the ground, *Ridley,* 70.

PEZIZA TRICHOLOMA, Mont.

Distr:—Perak, *King's collector,* 2633. Selangor, on dead wood, *Ridley,* 36.

HELOTIACEAE.

COOKEINA TRICHOLOMA, O. Ktze. Sharples, in Agric. Bull. F. M. S. ii. 83.

Distr:—Pahang, West Bentong, on old wood and bark, *Sharples.*

TRICHOPEZIZA CHRYSOTRICHA, Sacc.

Distr:—Selangor, on rotten twigs, *Ridley,* 47.

MOLLISIACEAE.

MOLLISIA ALBOFLAVA, Massee.

Distr:—Selangor, on a dead branch, *Ridley,* 62.

MOLLISIA CINNABARINA, Massee.

Distr:—Selangor, on dead branches, *Ridley,* 95.

MOLLISIA ROSEA, Massee.

Distr.—Selangor, on dead branches, *Ridley,* 82.

CENANGIACEAE.

DERMATEA MYCOPHAGA, Massee.

Distr:—Singapore, Bukit Timah, *Ridley,* 158.

TRYBLIDIELLA RUFULA, Sacc.

Distr:—Singapore, Botanic Gardens, on dead branches, *Ridley,* 6.

STICTIDACEAE.

SCHIZOXYLON sp.

Distr:—Singapore, Botanic Gardens, on bamboo, *Sappan,* 5142.

PHACIDIACEAE.

PHACIDIUM AFFINIS, Sacc. and Paol.

Distr:—Without precise locality, on leaves, *Scortechini,* 22.

HYPODERMATACEAE.

GLONIELLA FUSISPORA, Sacc. and Paol.

Distr:—Without precise locality, on stems, *Scortechini.*

LOPHODERMIUM MACULARE, De Not.

Distr:—Without precise locality, on dead leaves of Elateriospermum and Trigonostemon, *Scortechini,* 47, 48, 152.

HYSTERIACEAE.

LEMBOSIA GLONIOIDEA, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 119. Chipp, in Gard. Bull. S. S. ii. 189.

Distr:—Singapore, Botanic Gardens, on dead limbs of Hevea brasiliensis, *Baker,* 5278.

LEMBOSIA HEPTAPLEURI, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Botanic Gardens, on Heptapleurum, *Baker,* 442.

LEMBOSIA HORMOSIANA, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 278.

Distr:—Singapore, Botanic Gardens, on Ormosia sumatrana, *Baker*, 443.

LEMBOSIA MACROSPORA, Sacc. and Paol.

Distr:—Without precise locality, on fallen leaves, *Scortechini*, 117.

LEMBOSIA PANDANI, Theiss. Baker, in Gard. Bull. S. S. ii. 118. Chipp, in Gard. Bull. S. S. ii. 278.

Distr:—Singapore, Botanic Gardens, on dying leaves of Pandanus spp. *Baker*, 444, 4977.

HYSTERIUM HEVEANUM, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 119. Chipp, in Gard. Bull. S. S. ii. 189.

Distr:—Singapore, Botanic Gardens, on dead limbs of Hevea brasiliensis, *Baker*, 440.

EUTUBERACEAE.

TUBER ECHINATUM, Sacc. and Paol.

Distr:—Without precise locality, in holes in the ground, *Scortechini*, 185.

ASPERGILLACEAE.

MELIOLA AETHIOPS, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 233.

Distr:—Singapore, Botanic Gardens, on living leaves of Cassia fistula, *Baker*, 449.

MELIOLA AMPHITRICHA, Fries.

Distr:—Perak, *King's collector*, 2595. Without precise locality, on dead leaves and stems. *Scortechini*, 42.

MELIOLA KYDIAE, Sacc.

Distr:—Singapore, Botanic Gardens, on Garcinia kydia, *Baker*, 450.

MELIOLA MALACCENSIS, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 281.

Distr:—Singapore, Botanic Gardens, on leaves of Wormia suffruticosa, *Baker*, 451.

MELIOLA MANGIFERAE, Earle. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 288.

Distr:—Singapore, on Mango, *Burkill*, 2827. Singapore, Botanic Gardens, on leaves of Mangifera indica, *Baker*, 452.

Meliola Mangostanae, Sacc. Baker, in Gard. Bull. S. S. ii. 117.

Distr:—Singapore, Botanic Gardens, on leaves of Garcinia Mangostana, *Baker,* 453.

Meliola Nephelii, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 278.

Distr:—Singapore, Botanic Gardens, on leaves of Nephelium lappaceum, *Baker,* 454.

Meliola octospora, Cke.

Distr:—Singapore, Botanic Gardens, forming sooty patches on leaves of Eugenia grandis, *Ridley.*

Meliola palmarum, Kunze and Fries. Bancroft, in Agric. Bull. F. M. S. i. 259. Chipp, in Gard. Bull. S. S. ii. 235.

A sooty mould on coconut leaves.

Meliola reticulata, Karst. and Roum.

Distr:—Singapore, Botanic Gardens, on leaves of Ficus urophylla, *Baker,* 455.

ERYSIBACEAE.

Erysiphe Polygoni, D. C. Bancroft, in Agric. Bull. F. M. S. i. 112, 259. Chipp, in Gard. Bull. S. S. ii. 277.

Recorded as a mildew on tomatoes and cucumbers.

PERISPORIACEAE.

Dimerosporium albomarginatum, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 281.

Distr:—Singapore, Botanic Gardens, on dying leaves of Sterculia, *Baker,* 412.

Antennaria pannosa, Berk.

Distr:—Without precise locality, on dead leaves. *Scortechini,* 55.

Limacinia javanica, Sacc. Bancroft, in Agric. Bull. F. M. S. i. 27, 259. Chipp, in Gard. Bull. S. S. ii. 190.

Growing on a scale, Lecanium nigrum.

Apiosporium atrum, Massee. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Selangor, Kuala Lumpur, on dead branches of Hevea brasiliensis, *Bancroft.*

Capnodium sp. Belgrave, in Agric. Bull. F. M. S. iv. 113. Chipp, in Gard. Bull. S. S. ii. 236.

Recorded in association with scale insects as a sooty mould on coffee berries.

Microxyphium tenellum, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 234.

Distr:—Singapore, Botanic Gardens, on dying leaves of Cinnamomum iners, *Baker*, 468.

Dimerium sngaporense, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 280.

Distr:—Singapore, Reservoir Woods, on dead leaves of Rhodomyrtus tomentosa, *Baker*, 411.

MICROTHYRIACEAE.

Microthyrium browneanum, Sacc. Baker, in Gard. Bull. S. S. ii. 118. Chipp, in Gard. Bull. S. S. ii. 233, and 280.

Distr:—Singapore, Botanic Gardens, on Brownea grandiceps, and Saraca sp., *Baker*, 465, 466.

Microthyrium Grammatophylli, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on Grammatophyllum speciosum, *Baker*, 467.

Asterina tenuissima, Petch. Bancroft, in Agric. Bull. F. M. S. i. 259. Chipp, in Gard. Bull. S S. ii. 188, 191.

On the green stems and fruit of Hevea brasiliensis. Said by Petch to live on the sugary secretions from the nectaries at the base of the leaves.

Asterina trachycarpa, Syd. Baker, in Gard. Bull. S. S. ii. 118. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on Derris sinuata, *Baker*, 401.

Seynesia melanosticta, Cke. and Massee.

Distr:—Malacca, Mt. Ophir, on living leaves of Alsodeia, *Hullett*.

Micropeltis applanata, Mont.

var. Galeariae, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Changi, on Galearia affinis, *Baker*, 5893.

MICROPELTIS MARGINATA, Mont. Baker, in Gard. Bull. S. S. ii. 118. Chipp, in Gard. Bull. S. S. ii. 281.

Distr:—Singapore, Botanic Gardens, on Zalacca edulis, *Baker*, 5402, 5473; on Zalacca Wallichiana, *Baker*, 460.

MICROPELTIS TRIMERA, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on dead leaves of Gustavia insignis, *Baker*, 461.

HYPOCREACEAE.

NECTRIA DIVERSISPORA, Petch. Bancroft, in Agric. Bull. F. M. S. i. 28, 260. Chipp, in Gard. Bull. S. S. ii. 189, 191.

Recorded on dead parts of Hevea brasiliensis.

NECTRIA SANGUINEA, Fries. Ridley, in Agric. Bull. S. and F. M. S. ix. 571. Chipp, in Gard. Bull. S. S. ii. 189.

Recorded on the bark of Hevea brasiliensis.

PLEONECTRIA HEVEANA, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 118. Chipp, in Gard. Bull. S. S. ii. 190.

Distr:—Singapore, Botanic Gardens, on a dead limb of Hevea brasiliensis, *Baker*, 5173.

SPHAEROSTILBE CINNABARINA, Tul. Ridley, in Agric. Bull. S. and F. M. S. v. 68. Chipp, in Gard. Bull. S. S. ii. 280.

Recorded on roses.

SPHAEROSTILBE COCCOPHILA, Tul. Bancroft, in Agric. Bull. F. M. S. i. 260. Chipp, in Gard. Bull. S. S. ii. 234.

Recorded as parasitic on a scale on Citrus medica.

SPHAEROSTILBE REPENS, Berk. and Br. Brooks, in Agric. Bull. F. M. S. iii. 40; and in Dep. Agric. F. M. S. Bull. No. 25.

Recorded as a root disease of Hevea brasiliensis.

MEGALONECTRIA PSEUDOTRICHA, Speg. Bancroft, in Agric. Bull. F. M. S. i. 28, 260. Brooks, in Agric. Bull. F. M. S. iii. 41. Chipp, in Gard. Bull. S. S. ii. 189.

Recorded on dead parts of Hevea brasiliensis trees and considered by Brooks to be the conidial stage of Stilbum cinnabarinum.

HYPOCRELLA DISCOIDEA, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on living leaves of Schizocapsa plantaginea, *Baker*, 438.

HYPOCRELLA PANICI, Massee. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Selangor, on a Panicum, *Ridley,* 88.

HYPOCRELLA SCUTATA, Cke.

Distr:—Dindings, on leaves, mentioned by *Ridley.* Singapore, Botanic Gardens, on leaves of Myristica fragrans, *Dr. Bancroft.*

HYPOCRELLA ZINGIBERIS, Massee. Chipp, in Gard. Bull. S. S. ii. 282.

Distr:—Dindings, on petioles of Zingiber, *Ridley,* 10.

HYPOCREA DISCELLA, Berk. and Br.

Distr:—Without precise locality, on branches, *Scortechini,* 118.

HYPOCREA JECORINA, Berk. and Br.

Distr—Singapore, Botanic Gardens, on dead stumps, *M. Noor,* 5058; *Sappan,* 5071. Economic Garden, on a dead log, *Chipp,* 4846.

HYPOCREA sp. aff. H. CITRINAE.

Distr:—Singapore, Botanic Gardens, on a dead twig, *M. Noor,* 5354.

CORDYCEPS INTERRUPTA, Massee.

Distr:—Singapore, *Ridley.*

CORDYCEPS LIGNICOLA, Massee.

Distr:—Selangor, on rotten wood, *Ridley,* 41.

CORDYCEPS RIDLEYI, Massee.

Distr:—Selangor, on an ant Formica gigas, *Ridley,* 89.

BALANSIA ASPERATA, Massee. Bancroft, in Agric. Bull. F. M. S. i. 260. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Johore, Mount Austin, on an inflorescence of Ichnanthus pallens, *Ridley,* 12508.

BALANSIA SESSILIS, Massee. Bancroft, in Agric. Bull. F. M. S. i. 260. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Johore, Kuala Tebing, on Centotheca lappacea, and Ichnanthus sp., *Ridley,* 10988.

CLAVICEPS spp.

Many specimens of this genus have been collected, but the species are not worked out.

DOTHIDEACEAE.

MONTAGNELLA BOTRYOSA, Sacc. and Paol.

Distr:—Without precise locality, on leaves, *Scortechini,* 59.

ROUSSOELLA NITIDULA, Sacc. and Paol.

Distr:—Without precise locality, on thick bamboo stems, *Scortechini,* **15.**

DOTHIDEA PHASELINA, Berk.

Distr:—Singapore, on bamboo culms, 1879, *Beccari.*

PHYLLACHORA CANARII, P. Henn.

Distr:—Penang, Government Hill, on leaves of Canarium sp., *Chipp,* 4697.

PHYLLACHORA FICI-MINAHASSAE, P. Henn.

Distr:—Penang, Government Hill, at 1100 feet, on leaves of Ficus sp., *Chipp,* 4689, 4690.

PHYLLACHORA LUCIDA, Sacc. and Paol.

Distr:—Without precise locality, on dying subcoriaceous leaves, *Scortechini,* 67.

DOTHIDELLA PTEROCARPI, Massee. Bancroft, in Agric. Bull. F. M. S. i. 151, 260. Chipp, in Gard. Bull. S. S. ii. 280.

Distr:—Selangor, Kuala Lumpur, on living leaves of Pterocarpus indicus, *Bancroft.*

ZIMMERMANIELLA TRISPORA, P. Henn. Baker, in Gard. Bull. S. S. ii. 118. Chipp, in Gard. Bull. S. S. ii. 288.

Distr:—Singapore, Botanic Gardens, on dead leaves of Mangifera indica, *Baker,* 500.

SORDARIACEAE.

SORDARIA BURKILLII, Massee.

Distr:—Singapore, Botanic Gardens, on cattle dung, *Burkill.*

SPHAERIACEAE.

TRICHOSPHAERIA SACCHARI, Massee. Ridley, in Agric. Bull. Mal. Penin. 1897, No. 7, p. 146. Chipp, in Gard. Bull. S. S. ii. 280.

On sugar cane, recorded by Ridley.

Rosellinia ambigens, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore. Botanic Gardens, on dead leaves of Daemonorops, *Baker,* 483.

Rosellinia bunodes, Sacc.

Distr:—Singapore, Botanic Gardens, on Ficus dubia, *Ridley.*

This specimen was originally determined as R. echinata, by Massee.

Rosellinia echinata, Massee.

Considered by Butler and Wakefield to be the same as R. bunodes.

Rosellinia hemisphaerica, Sacc. and Paol.

Distr:—Perak, *King's collector.* Without precise locality, on decaying leaves of Dracaena, *Scortechini,* 2.

Rosellinia mammoidea, Sacc.

Distr:—Perak, *King's collector.* Without precise locality, on dead twigs, *Scortechini,* 3, 10.

Rosellinia picacea, Massee.

Distr:—Singapore, Botanic Gardens, on dead bark, *Ridley.*

Rosellinia radiciperda, Massee. Ridley, in Agric. Bull. Mal. Penin. 1900, page 287.

Distr:—Singapore, Botanic Gardens, on jungle trees, *Ridley.*

Rosellinia sp. aff. R. parasiticae. E. and Ev. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, Botanic Gardens, on a stem of Pinanga, *Chipp,* 4925.

Zignoella Garciniae, P. Henn. Belgrave, in Agric. Bull. F. M. S. ii. 229.

Recorded on Garcinia mangostana.

Melanomma tornatum, Sacc. and Paol.

Distr:—Without precise locality, on dead stems, *Scortechini,* 7.

CERATOSTOMATACEAE.

Ceratostomella coprogena, Massee.

Distr:—Singapore, Botanic Gardens, on cattle dung, *Burkill.*

CERATOSPHAERIA SUBICULOSA, Sacc. Baker, in Gard. Bull. S. S. ii. 117.

Distr:—Singapore, Botanic Gardens, on leaves of Fagraea auriculata, *Baker,* 5471.

OPHIOCERAS DIAPORTHOIDES, Sacc. and Paol.

Distr:—Without precise locality, on a thorny woody plant, *Scortechini,* 86.

CUCURBITARIACEAE.

CUCURBITARIA AGAVES,

Distr:—Penang, Waterfall Gardens, on dead leaves of Agave, *Burkill,* 4139. Johore, Kukob, on leaves of Agave sisalana, *Overbeck,* A17; *Burkill,* A49.

NEOTROTTERIA PULCHELLA, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 117. Chipp, in Gard. Bull. S. S. ii. 189.

Distr:—Singapore, Botanic Gardens, on rotting limbs of Hevea brasiliensis, *Baker,* 5277.

AMPHISPHAERIACEAE.

TREMATOSPHAERIA CLYPEATA, Sacc. and Paol.

Distr:—Without precise locality, on dead branches, *Scortechini,* 17.

WINTERINA BAKERIANA, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 277.

Distr:—Singapore, Botanic Gardens, on dead leaves of Livistona sinensis, *Baker,* 497.

MYCOSPHAERELLACEAE.

LAESTADIA CAMELLIAE, Berk.

Distr:—Johore, on leaves of Camellia thea, *King's collector.*

LAESTADIA PALAQUII, Bancroft, in Agric. Bull. S. and F. M. S. x. 108; and in Agric. Bull. F. M. S. i. 113, 260. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Perak, parasitic on leaves of Palaquium oblongifolium, *Bancroft.*

LAESTADIA THEAE, Rac. Bancroft, in Agric. Bull. F. M. S. i. 113, and 260. Chipp, in Gard. Bull. S. S. ii. 281.

Distr:—Negri Sembilan, on leaves of tea, *Bancroft.*

SPHAERELLA ANALOGA, Sacc. and Paol.

Distr:—Perak, *King's collector.* Without precise locality, on dying leaves, *Scortechini,* 190.

SPHAERELLA CAMELLIAE, Cke. Bancroft, in Agric. Bull. F. M. S. i. 260.

Distr:—Johore, on leaves of Camellia thea, *King's collector.*

SPHAERELLA CYCLOGONA, Sacc. and Paol.

Distr:—Perak, *King's collector.* Without precise locality, on dying leaves, *Scortechini.*

SPHAERELLA HEVEANA, Sacc. Baker, in Gard. Bull. S. S. ii. 111 and 117. Chipp, in Gard. Bull. S. S. ii. 190.

Distr:—Singapore, Botanic Gardens, on dead leaves of Hevea brasiliensis, *Baker,* 488; Economic Garden, *Chipp,* 5764.

SPHAERELLA LASIANA, Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 277.

Distr:—Singapore, Botanic Gardens, on leaves of Lasia heterophylla, *Baker,* 489.

SPHAERELLA TRISTANIAE, Wakef. Chipp, in Gard. Bull. S. S. ii. 281.

Distr:—Penang, Moniot Road, on leaves of Tristania Griffithii, *Chipp,* 4694.

PLEOSPORACEAE.

PHYSALOSPORA IMMERSA, Massee.

Distr:—Singapore, Botanic Gardens, on cattle dung, *Burkill.*

DIDYMELLA OLIGOSPORA, Sacc. Baker, in Gard. Bull. S. S. ii. 111 and 117. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Singapore, Botanic Gardens, on dead branches of Hevea brasiliensis, *Baker,* 410.

METASPHAERIA COCOES. Chipp, in Gard. Bull. S. S. ii. 235.

Distr:—Without precise locality, on dead leaves, *Richards.*

CLYPEOSPHAERIACEAE.

TRABUTIA STEPHANIAE. Bancroft, in Agric. Bull. F. M. S. i. 260. Chipp, in Gard. Bull. S. S. ii. 231.

Distr:—Perak, on leaves of Afzelia retusa, *Bancroft.*

VALSACEAE.

ANTHOSTOMA CAPNODES, Sacc.

Distr:—Perak, *King's collector*. Without precise locality, on branches, *Scortechini*, 65.

ANTHOSTOMA EUMORPHUM, Sacc. and Paol.

Distr:—Perak, *King's collector*. Without precise locality, on dead stems, *Scortechini*, 6.

ANTHOSTOMA PACHYDERMA, Sacc. and Paol.

Distr:—Without precise locality, on bark, *Scortechini*, 7.

VALSA ASSIMILIS, Ces.

Distr:—Penang, on bark, May 1865, *Beccari*.

VALSA SABALINA.

Distr:—Singapore, Botanic Gardens, on dead branchlets, *Ridley*, 140.

EUTYPA CAULIVORA, Massee. Ridley, in Agric. Bull. S. and F. M. S. ix. 217, 259, 460. Bancroft, in Agric. Bull. F. M. S. i. 259, 260; and in Dep. Agric. F. M. S. Bull. No. 25. Chipp, in Gard. Bull. S. S. ii. 188, and 277.

Recorded by Ridley and Bancroft on Hevea brasiliensis and jungle trees.

EUPTYPA LUDIBUNDA, Sacc.

VAR. HEVEANA Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 117. Chipp, in Gard. Bull. S. S. ii. 189.

Distr:—Singapore, Botanic Gardens, on dead limbs of Hevea brasiliensis, *Baker*, 417.

PERONEUTYPA HETERACANTHOIDES, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 117. Chipp, in Gard Bull. S. S. ii. 189, and 234.

Distr:—Singapore, Botanic Gardens, on dead limbs of Hevea brasiliensis and Cassia, *Baker*, 470, 471.

CRYPTOVALSA MICROSPORA, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 117. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Singapore, Botanic Gardens, on rotting stems of Hevea brasiliensis, *Baker*, 409.

Eutypella bambusina, Berl.

Distr:—Johore, Pagoh, Muar, on dead bamboo, *South,* 6073. Singapore, Government House Grounds, on bamboo twigs, *Burkill,* 2214.

Thyridaria tarda, Bancroft, in Agric. Bull. F. M. S. i. 260; and in Dep. Agric. F. M. S. Bull. Nos. 14, 16, 18. Chipp, in Gard. Bull. S. S. ii. 190.

Recorded as a cause of "die back" on Hevea brasiliensis.

MELANCONIDACEAE.

Valsaria Cinnamomi, Sacc. Baker, in Gard. Bull. S.. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 238.

Distr:—Singapore, Botanic Gardens, on dead bark of Eugenia grandis, *Baker,* 496.

DIATRYPACEAE.

Diatrype excitans, Cke.

Distr:—Selangor, on dead wood, *Ridley,* 44.

XYLARIACEAE.

Nummularia pithodes, Petch. Bancroft, in Agric. Bull. F. M. S. i. 260. Brooks, in Agric. Bull. F. M. S. iii. 106. Chipp, in Gard. Bull. S. S. ii. 189.

Common on dead branches and roots of Hevea brasiliensis. According to Petch this species is the same as Eutypa caulivora, Mass.

Nummularia punctulata, Sacc.

Distr:—Singapore, Botanic Gardens, on a dead branch of Albizzia, *M. Noor,* 5664; on a dead twig, *Kiah,* 5736; Economic Garden, on a dead root of Hevea brasiliensis, *Chipp,* 5753.

var. indica, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on dead limbs of Gluta benghas, *Baker,* 5371.

Nummularia repandoides, Fuck.

var. singaporensis, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 118. Chipp, in Gard. Bull. S. S. ii. 189.

Distr:—Singapore, Botanic Gardens, on dead limbs of Hevea brasiliensis, *Baker,* 469.

USTULINA ZONATA, Sacc. Brooks, in Agric. Bull. F. M. S. iii. 105. Sharples, in Agric. Bull. F. M. S. iv. 98; and in Dep. Agric. F. M. S. Bull. Nos. 22 and 25. Chipp, in Gard. Bull. S. S. ii. 187.

Distr:—Selangor, Kuala Lumpur, *Belgrave,* 4996; on dead Eucalyptus, *Chipp*, 5682. Johore, Pagoh, Muar, on a stump of Areca catechu, *South,* 6072. Singapore, Mandai Road, on a dead stump, *Chipp,* 5820. Botanic Gardens, on dead bamboo, *Sappan,* 5146; on a living tree of Canarium commune, *Chipp,* 6169.

Specimens 4996, and 5146 were determined by Lloyd as U. vulgaris.

HYPOXYLON APPROXIMANS, Ces.

Distr:—Singapore, 1879, *Beccari.*

HYPOXYLON CONCENTRICUM, Grev.

Distr:—Perak, *Kunstler.*

HYPOXYLON EFFUSUM, Nits. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Botanic Gardens, Singapore, on rotting bark, *Baker,* 5122. Without precise locality, on branches, *Scortechini,* 57, 183.

var. VIRIDARII, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on rotting bark, *Baker.*

HYPOXYLON HAEMATITES, Lev.

Distr:—Singapore, Botanic Gardens, *Ridley,* 171.

HYPOXYLON MICROSPORUM, Ces. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 234.

Distr:—Singapore, Botanic Gardens, on dead bark of Cassia, *Baker*, 439.

HYPOXYLON OODES, Berk. and Br. Bancroft, in Agric. Bull. F. M. S. i. 260. Chipp, in Gard. Bull. S. S. ii. 189.

Distr:—Perak and Selangor, on dead branches of Hevea brasiliensis, *Bancroft.*

HYPOXYLON UDUM, Fries.

Distr:—Singapore, 1879, *Beccari.*

Daldinia concentrica, Ces. and De Not. Bancroft, in Agric. Bull. F. M. S. i. 28, 260. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Perak, *King's collector.* Singapore, Botanic Gardens, *Flippance,* 5647, Economic Garden, on dead wood, *Chipp,* 5464. This is the obovoid form known as D. luzonensis, Rehm.

Common everywhere on dead logs.

var. Escholzii, Ehrenb. Baker, in Gard. Bull. S. S. ii. 111 and 118. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Singapore, Botanic Gardens, on a dead trunk of Hevea brasiliensis, *Baker.*

Daldinia vernicosa, Ces. and De Not.

Distr:—Penang, Waterfall Gardens, on dead wood, *Curtis,* 2213. Selangor, *Ridley,* 84. Singapore, Botanic Gardens, on logs, *Ridley,* 4.

Kretzschmaria Botrytis, Lloyd.

Distr:—Singapore, Economic Garden, on dead stem of Hevea brasiliensis, *Sappan,* 5433.

Kretzschmaria Heliscus, Massee.

Distr:—Singapore, Botanic Gardens, on dead bark, *Ridley,* 7.

Kretzchmaria singaporensis, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on rotting trunks, *Baker,* 5299.

Xylaria acicula, Ces.

Distr:—Without precise locality, on thick leaves, *Scortechini,* 119.

Xylaria acicularis, Cke.

Distr:—Selangor, on rotten wood, *Ridley,* 63. Singapore, Botanic Gardens, *Ridley,* 53.

Xylaria allantoidea, Berk.

Distr:—Selangor, Port Swettenham, on dead mangrove below high tide mark, *Chipp,* 5640. Sungei Buloh, *Hashim,* 5011. Singapore, Woodlands, on dead wood, *M. Noor,* 5380. Botanic Gardens, *Ridley,* 4919; on an ant's nest, *M. Noor,* 5828.

XYLARIA BERKELEYI, Mont.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor*, 5591.

XYLARIA CYNOGLOSSA, Cke. Bancroft, in Agric. Bull. F. M. S. i. 28 and 260. Chipp, in Gard. Bull. S. S. ii. 188.

Recorded on a dead root of Hevea brasiliensis.

XYLARIA DIGITATA, Grev.

Distr:—Without precise locality, on branches, *Scortechini*, 66, 95.

XYLARIA EMERICI, Berk.

Distr:—Selangor, recorded by *Ridley*.

XYLARIA EUCEPHALA, Sacc. and Paol.

Distr:—Without precise locality, amongst moss on the branches of trees, *Scortechini*, 188.

XYLARIA EXALBATA, Berk. and Curt.

Distr:—Penang, Balik Pulau, *Ridley*, 164.

XYLARIA FIBULA, Massee.

Distr:—Singapore, Bukit Timah, on dead wood, *Ridley*, 159.

XYLARIA FURCATA, Fries.

Distr:—Penang, Waterfall Gardens, on a termites' nest, *M. Noor*, 5625. Singapore, Bukit Timah, on a jungle path, *Chipp*, 4926. Blakang Mati, on the seashore below high tide mark, *Chipp*, 5453.

XYLARIA GRACILIS, Kl.

Distr:—Selangor, Pahang Track, *Ridley*, 83.

XYLARIA GUEPINI, Ces.

Distr:—Without precise locality, on stems, *Scortechini*, 36.

XYLARIA HOLOBAPHA, Berk. Bancroft, in Agric. Bull. F. M. S. i. 260.

Distr:—Perak, Maxwell hill, at 2500 feet, *Bancroft*.

XYLARIA HYPOXYLON, Fries.

VAR. MUCRONATA, Berk.

Distr:—Singapore, Botanic Gardens, on dead wood, *Ridley*, 14; on dead roots of a Ficus, *E. M. Burkill*, 97.

XYLARIA HYPSIPODA, Massee.

Distr:—Singapore, Bukit Mandai, gregarious on dead leaves, *Ridley*, 34.

XYLARIA IANTHOVELUTINA, Mont.

Distr:—Perak, Larut, on rotten wood, *King's collector*, 2252.

XYLARIA KEDAHAE, Lloyd.

Distr:—Kedah Peak, at 3000 feet, on the ground, *M. Noor*, 4982.

XYLARIA NIGRIPES, Kl.

Distr:—Singapore, Botanic Gardens, on the ground, *Sappan*, 5426. Without precise locality, on branches, *Scortechini*, 101.

XYLARIA OBOVATA, Berk. Baker, in Gard. Bull. S. S. ii. 111, and 118. Chipp, in Gard. Bull. S. S. ii. 190.

Distr:—Singapore, Botanic Gardens, on stumps of Hevea brasiliensis, *Baker*, 5376.

XYLARIA OLIGOSTOMA, Sacc. and Paol.

Distr:—Without precise locality, on logs, *Scortechini*, 28.

XYLARIA PLEBEJA, Ces.

Distr:—Without precise locality, on bark, *Scortechini*.

XYLARIA POLYCLADA, Fries.

Distr:—Without precise locality, on logs, *Scortechini*.

XYLARIA POLYMORPHA, Grev. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on dead logs, *Baker*, 5297; *E. M. Burkill*, 188. Economic Gardens, *A. Kadir*, 5415.

XYLARIA RHOPALOIDES, Kunze.

Distr:—Singapore, Botanic Gardens, *Ridley*, 127; on the stump of an Albizzia, *E. M. Burkill*, 185, 298.

XYLARIA RIDLEYI, Massee.

Distr:—Selangor, Pahang Track, *Ridley*, 80. Singapore, Botanic Gardens, *Ridley*, 15.

Xylaria Schweinitzii, Berk.

Distr:—Selangor, Pahang Track, *Ridley,* 81. Singapore, Botanic Gardens, *Ridley,* 136.

Xylaria scopiformis, Mont. Bancroft, in Agric. Bull. F. M. S. i. 260. Chipp, in Gard. Bull. S. S. ii. 190.

Distr:—Perak, on dead wood, *Bancroft.* Singapore, Botanic Gardens, *Ridley,* 57.

var. heveana, Sacc. Baker, in Gard. Bull. S. S. ii. 111, and 118.

Distr:—Singapore, Botanic Gardens, on a stump of Hevea brasiliensis, *Baker,* 5283.

Xylaria tuberiformis, Berk. Baker, in Gard. Bull. S. S. ii. 111, and 118. Chipp, in Gard. Bull. S. S. ii. 190.

Distr:—Singapore, Botanic Gardens, on stumps of Hevea brasiliensis, *Baker,* 498.

Xylaria varians, Sacc. Baker, in Gard. Bull. S. S. ii. 118.

Distr:—Singapore, Botanic Gardens, on rotting trunks, *Baker,* 499.

Poronia oedipus, Mont. Bancroft, in Agric. Bull. F. M. S. i. 260.

Distr:—Perak, on dead wood, at 550 feet, *Bancroft.* Without precise locality, on elephant dung, *Scortechini,* 94.

Penzigia crainoides, Sacc. and Paol.

Distr:—Without precise locality, on stems, *Scortechini,* 50, 176.

Penzigia dealbata, Sacc. and Paol.

Distr:—Without precise locality, on stems, *Scortechini,* 135, 186.

BASIDIOMYCETES.

USTILAGINACEAE.

Ustilago flavo-nigrescens, Berk. and Curt. Chipp, in Gard. Bull. S. S. ii. 280.

Distr:—Singapore, Ulu Berik, on Scleria sumatrensis, *Burkill*

Ustilago Maydis, D. C. Ridley, in Agric. Bull. Mal. Penin. 1898, p. 198. Chipp, in Gard. Bull. S. S. ii. 282.

Recorded on cobs of Zea Mays.

USTILAGO POLYTRIADIS, Massee. Chipp, in Gard. Bull. S. S. ii. 280.

Distr:—Malacca, in the ovaries of Polytrias praemorsa.

USTILAGO THWAITESII, Berk. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Bajau, on leaves of Justicia Gendarussa, *Burkill.*

USTILAGO VIRENS, Cke. Chipp, in Gard. Bull. S. S. ii. 278.

Recorded by Bancroft as parasitic on grains of rice in Perak.

CEREBELLA PASPALI.

Distr:—Singapore, Kranji, 1891, *Ridley.*

GRAPHIOLA MACROSPORA, Penz. and Sacc. Baker, in Gard. Bull. S. S. ii. 117. Chipp, in Gard. Bull. S. S. ii. 79.

Distr:—Singapore, on dying petioles of Plectocomia, *Baker,* 429*a.*

PUCCINIACEAE.

HEMILEIA VASTATRIX, Berk. and Br. van Hall, in Agric. Bull. F. M. S. i. 251, 255. Bancroft, in Agric. Bull. F. M. S. i. 261. Belgrave, in Agric. Bull. F. M. S. iv. 111. Chipp, in Gard. Bull. S. S. ii. 236.

Distr:—Malacca, Jasin, on Coffea robusta, *Burkill,* 460.

Commonly reported as parasitic on coffee leaves.

PUCCINIA CLAVISPORA, Ell. and Barth. Baker, in Gard. Bull. S. S. ii. 116. Chipp, in Gard. Bull. S. S. ii. 232.

Distr:—Singapore, on Andropogon nardus v. citronella, *Baker,* 482.

AECIDIUM BALANSAE, Cor. Baker, in Gard. Bull. S. S. ii. 116. Chipp, in Gard. Bull. S. S. ii. 231.

Distr:—Penang, Government Hill, at 2500 feet, on Agathis alba, *Burkill*, 2574.

AECIDIUM CASSIAE, Bres. Baker, in Gard. Bull. S. S. ii. 116. Chipp, in Gard. Bull. S. S. ii. 233.

Distr:—Singapore, Tanjong Pagar, on Cassia tora, *Burkill,* 1285.

Considered at Kew to be A. Torae, P. Henn.

There are also many other collections which have not yet been determined specifically.

Uredo Dioscoreae, P. Henn.

Distr:—Singapore, Economic Garden, on leaves of Dioscorea bulbifera, *Burkill*.

Uredo Dioscoreae-alatae, Rac.

Recorded from Burkill's collection.

Uredo Imperatae, P. Magn. Bancroft, in Agric. Bull. F. M. S. i. 261. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Selangor, on Imperata arundinacea, *Bancroft*.

AURICULARIACEAE.

Auricularia Auriculae-judae (L.) Schroet.

Distr:—Singapore, on dead wood, *E. M. Burkill*, 191.

Common on all kinds of damp and rotting wood, throughout the country.

Auricularia brasiliensis, Fr.

Distr:—Johore, on pit shafts used in the Causeway Works, Johore Bahru, *Chipp*, 5831, 5898. Singapore, on dead wood, Woodlands, *Sappan* 5393. Botanic Gardens, *Chipp*, 5783. On dead stem of Hevea brasiliensis, Economic Gardens, *Kiah*, 5850.

The glabrous "Jew's Ear." Large specimens often measure 6 in. in diameter.

Auricularia indica, Massee.

Distr:—Singapore, Cluny Road, on a dead log, *E. M. Burkill*, 210.

The type specimen only is known so far.

Auricularia mesenterica, Fries.

Distr:—Singapore, Economic Gardens, growing on a species of Baccaurea, *Sappan*, 5430.

A European species now recorded for the first time from Malaya.

Auricularia polytricha, (Mont.) Sacc. Chipp, under Hirneola polytricha, in Gard. Bull. S. S. ii. 189.

Distr:—Without precise locality, appearing in clusters at the ends of dead branches or wounded parts, *Bancroft*.

This fungus is stated to be used in curries.

Auricularia porphyrea, (Fr.)

Distr:—Selangor, recorded by *Ridley*, 20.

Auricularia reflexa, Berk.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan,* 5428.

TREMELLACEAE.

Heterochaete tenuicula, Pat.

Distr:—Singapore, Bukit Timah, on dead wood, *Chipp,* 5863.

Tremella picea, Massee.

Distr:—Selangor, on dead wood, recorded by *Ridley,* 27.

Tremellodon aurantiacum, Massee.

Distr:—Selangor, on rotten wood, *Ridley,* 72.

DACRYOMYCETACEAE.

Guepinia buccina, Sacc.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini.*

Guepinia cochleata, Berk.

Distr:—Singapore, recorded by *Ridley.*

Guepinia flabellata, Cke. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Perak, Gopeng, on rotten logs, *Kunstler,* 646. Without precise locality, common on rotten logs, *Bancroft.*

Guepinia spathularia, Schw. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Singapore, Botanic Gardens, on a dead branch of Ficus Benjamina, *E. M. Burkill,* 280. Economic Gardens, on a dead log, *Chipp,* 4843. Without precise locality, common on dead logs, *Bancroft.*

Calocera Hostmanni, Lev.

Distr:—Perak, *King's collector.* Without precise locality, *Scortechini,* 13.

Calocera stricta, Fries. Sharples, in Agric. Bull. F. M. S. ii. 84.

Distr:—Without precise locality, occurring very commonly on dead wood in newly opened rubber plantations, *Sharples.*

Calocera viscosa, Pers.

Distr:—Perak, *King's collector.* Without precise locality, on wood, *Scortechini,* 12.

THELEPHORACEAE.

CORTICIUM CALCEUM, Fries. Ridley, in Agric. Bull. S. and F. M. S. v. 69. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Without precise locality, on the bark of Hevea brasiliensis, *Ridley*.

CORTICIUM INCARNATUM, Fries.

Distr:—Without precise locality, on dead wood, *Scortechini.*

CORTICIUM JAVANICUM, Zimm. Bancroft, in Agric. Bull. F. M. S. i. 28. Sharples, in Agric. Bull. F. M. S. iii. 203. Chipp, in Gard. Bull. S. S. ii. 188.

Commonly reported on trees throughout the country. Considered as one of the causes of "Pink Disease."

CORTICIUM LACTEUM, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on wood and branches, *Scortechini,* 24.

CORTICIUM LAEVE, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on decaying wood, *Scortechini,* 120.

CORTICIUM SALMONICOLOR, Berk. and Br. Bancroft, in Agric. Bull. F. M. S. i. 218, 261. Brooks, in Agric. Bull. F. M. S. ii. 238. Bancroft, in Dep. Agric. F. M. S. Bull. No. 18. Brooks and Sharples, in Dep. Agric. F. M. S. Bull. No. 21. Chipp, in Gard. Bull. S. S. ii. 188, 232, 233, 234, 235, 236, 237, 276, 277, 280, 281.

Commonly reported on trees throughout the country, and treated at some length by Brooks and Sharples, and by Bancroft in the bulletins of the Agricultural Department F. M. S. Considered as one of the causes of "Pink Disease."

STEREUM ANNOSUM, Berk. and Br.

Distr:—Perak, *King's collector.* Without precise locality, on wood, *Scortechini,* 97.

STEREUM ASTREA, Fries.

Distr:—Perak, *King's collector.*

STEREUM ATERRIMUM, Cke. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Perak, Goping, on rotting wood in open dry ground, *Kunstler.* Singapore, Botanic Gardens, on dead wood, *Ridley,* 48. On a dead palm. *Sappan,* 5072.

STEREUM BICOLOR, Fries .

Distr:—Singapore, Economic Gardens, on a dead log, *Chipp*, 4844.

STEREUM BOLLEANUM, Mont.

Distr:—Singapore, Botanic Gardens, on the ground, *Sappan*, 5147.

STEREUM CAPERATUM, Berk.

Distr:—Perak, *King's collector*, 943.

STEREUM COCOA, Berk.

Distr:—Selangor, Kanching Forest Reserve, on dead wood, *Chipp*, 5506.

STEREUM CUNEIFORME, Lloyd.

Distr:—Singapore, Economic Gardens, on the damp earth among the roots of Hevea brasiliensis, *E. M. Burkill*, 189, 254, 288.

STEREUM ELEGANS, Fries.

Distr:—Perak, *King's collector*.

STEREUM INCISUM, Lloyd.

Distr:—Singapore, Botanic Gardens, on the ground, *M. Noor*, 5134.

STEREUM INVOLUTUM, Kl. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Perak, *Kunstler*, 645. Singapore, Botanic Gardens, on dead wood, *Sappan*, 5149. Economic Garden, on a dead twig, *Sappan*, 5429.

STEREUM LATUM, Cke. and Massee.

Distr:—Perak; on dead bark. Singapore, Botanic Gardens, on dead wood, *Sappan*, 5111. This specimen is considered at Kew to be S. percome, B. and Br.

STEREUM LOBATUM, Kunze. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Perak, *Kunstler*, 620. *King's collector*, 4864, 2056. Penang, Waterfall, on dead wood, *Curtis*, 2188, 2189, 2190, 2194. Selangor, *Ridley*, 124. Singapore, Chua Chu Kang, *Ridley*, 2. Botanic Gardens, *Ridley*, 68, 69, 116, 128, 129.

This species seems to be distributed throughout the country.

Stereum Mellisii, Berk.

Distr:—Perak, *Kunstler,* 634.

Stereum monochroum, Cke. and Massee.

Distr:—Perak, on dead wood.

Stereum nitidulum, Berk.

Distr:—Selangor, *Ridley,* 79. Johore, Tebong Tinggi, *Ridley,* 10989. Singapore, Botanic Gardens, *Ridley,* 8.

Stereum Ostrea, Fries.

Distr:—Without precise locality, on logs, *Scortechini,* 16. 86, 113.

Stereum partitum, Berk. and Br.

Distr:—Singapore, Botanic Gardens, *Ridley,* 51.

Stereum percome, Berk. and Br.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan,* 5111.

This specimen is regarded by Lloyd as being S. latum.

Stereum petalodes, Berk.

Distr:—Singapore, Botanic Gardens, *Ridley,* 58.

Stereum rimosum, Berk.

Distr:—Perak, Taiping Hill, *M. Haniff,* 2370.

Stereum spadiceum, Fries.

Distr:—Perak, *King's collector,* 3604. Singapore, Botanic Gardens, *Ridley,* 29.

Stereum spectabile, Kl.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan,* 5122.

Stereum tenuissimum, Berk.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5621. Selangor, Port Swettenham, on dead mangrove below high tide mark, *Chipp,* 5632.

Stereum vellereum, Berk.

Distr:—Selangor, Batu Caves, on dead wood, *Ridley.* Singapore, Botanic Gardens, *Ridley,* 5.

Cladoderris cartilaginea, Massee.

Distr:—Singapore, Botanic Gardens, on decayed wood buried in the ground, *Ridley*, 47.

Lloyd considers this to be a Tremellaceous plant of unique structure.

Cladoderris dendritica, Pers. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Penang, Balik Pulau, *Ridley*. Perak, *King's collector*, 2166, 3133. Singapore, Botanic Gardens, *Ridley;* Napier Road, on dead wood, *Sappan*, 5369.

Cladoderris infundibuliformis, Kl.

Distr:—Selangor, Sungei Buloh, on dead wood, *Hashim*, 5009.

Cladoderris spongiosa, Fries. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Perak, *Kunstler*, 616.

Cladoderris Thwaitesii, Berk.

Distr:—Singapore, Botanic Gardens, on bamboo shoots, *Ridley*, 38.

Considered by Lloyd to be a Tremellaceous plant of the same affinity as Ridley's specimen 47, determined by Massee as C. cartilaginea.

Beccariella kingiana, Massee.

Distr:—Perak, Goping, on rotting logs in damp places, *King's collector.*

Craterellus cornucopioides, Fries.

Distr:—Perak, *King's collector.* Selangor, Kuala Lumpur, *M. Noor*, 5582. Without precise locality, on logs, *Scortechini*, 99.

Craterellus verrucosa, Massee.

Distr:—Penang, on the ground at the foot of the hill, *Ridley*, 163.

Cyphella Heveae, Massee. Richards, in Agric. Bull. F. M. S. v. 308. Chipp, in Gard. Bull. S. S. ii. 188.

Distr:—Province Wellesley, on bark of Hevea brasiliensis, *Richards.*

Hymenochaete Cacao, Berk.

Distr:—Perak, Maxwell's Hill, *Wray*, 13. Selangor, *Ridley*, 117. Kuala Lumpur, *Chipp*, 5696.

Hymenochaete depallens, Berk. and Br.

Distr:—Singapore, *Beccari*.

Hymenochaete noxia, Berk. Bancroft, in Agric. Bull. F. M. S. i. 219, and 261. South, in Agric. Bull. F. M. S. vi. 269. Chipp, in Gard. Bull. S. S. ii. 187.

Recorded by Bancroft for Perak, Selangor, Negri Sembilan, and Johore. One of the causes of "brown root disease" of rubber, coffee, camphor, etc.

Hymenochaete pellicula, Berk. and Br.

Distr:—Perak, *King's collector*. Without precise locality, on branches of Eugeissona tristis, *Scortechini*, 40, 42.

Hymenochaete phaca, Berk.

Distr:—Penang, at the top of the hill, *Ridley*, 162. Selangor, Ginting Bidai, *Ridley*, 167. Kuala Lumpur, *Belgrave*, 4993.

Hymenochaete strigosa, Berk. and Br.

Distr:—Perak, *King's collector*. Without precise locality, on logs, *Scortechini*, 40, 180.

Hymenochaete subpurpurascens, Berk.

Distr:—Perak, *King's collector*, 791.

Hymenochaete tabacina, Lev.

Distr:—Perak, *King's collector*. Without precise locality, on branches, *Scortechini*, 147 .

Asterostroma hapalum, Berk. and Br.

Distr:—Singapore, Botanic Gardens, on a dead vine, *Baker*, 5129.

Asterostroma investiens, Schw.

Distr:—Singapore, Blakang Mati, on branches of dead mangrove between low and high tide marks, *Chipp*, 5446.

Helicobasidium Mompa, Tanaka. Ridley, in Agric. Bull. S. and F. M. S. i. 81. Chipp, in Gard. Bull. S. S. ii. 187.

Distr:—Selangor, *Ridley*. Doubtfully referred to this species by Massee.

RHIPIDONEMA LIGULATUM, Matt.

Distr:—Perak, *King's collector.* Singapore, on branches, *Scortechini*, 11.

CLAVARIACEAE.

PISTILLARIA FULGIDA, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on dead fruits of Nephelium glabrum, *Scortechini,* 37.

CLAVARIA BICOLOR, Massee.

Distr:—Penang, Gardens' Jungle, recorded by *Ridley.*

CLAVARIA CANDELABRA, Massee.

Distr:—Selangor, on rotten wood, *Ridley,* 37.

CLAVARIA FRAGILIS, Holmsk.

Distr:—Singapore, Botanic Gardens, common on the rockeries, *Ridley.*

CLAVARIA FUSIFORMIS, Sowerby.

Distr:—Pahang, Gunong Tahan, growing among moss, 3300 feet altitude, *Robinson and Wray,* 5346.

CLAVARIA ORNITHOPODA, Massee.

Distr:—Penang, on the ground, *Ridley.*

CLAVARIA RIDLEYI, Massee.

Distr:—Perak, on the ground at the base of trees, *Brown,* 19.

CLAVARIA RUFESCENS, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on wood, *Scortechini,* 21.

CLAVARIA STRICTA, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on old logs, *Scortechini,* 9.

CLAVARIA TRICHOCLADA, Sacc. and Paol.

Distr:—Perak, *King's collector.* Without precise locality, on logs, *Scortechini.*

CLAVARIA TRICHOTOMA, Lev.

Distr:—Perak, *King's collector.* Without precise locality, on logs, *Scortechini,* 14.

CLAVARIA THWAITESII, Berk. and Br.

Distr:—Singapore, *Beccari.*

PTERULA SIMPLEX, Sacc. and Paol.

Distr:—Perak, *King's collector.* Without precise locality, on bark from a fallen tree, *Scortechini,* 159.

PTERULA TROPICA, Mont.

Distr:—Perak, *King's collector.* Without precise locality, on dead logs, *Scortechini.*

LACHNOCLADIUM BRASILIENSE, Sacc. A. L. Smith, in Journ. F. M. S. Museum, ii. 142.

Distr:—Pahang, Gunong Tahan, on dead wood, 3300 feet altitude, *Robinson and Wray,* 5416.

LACHNOCLADIUM FURCELLATUM, Sacc. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Perak, 300 feet altitude, on dead wood, *Bancroft.* Selangor, Batu Caves, on rotten wood, *Ridley,* 19.

LACHNOCLADIUM SEMIVESTITUM, Berk. and Curt.

Distr:—Perak, *King's collector,* 4036.

HYDNACEAE.

LOPHARIA MIRABILIS, Pat. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Selangor, Kuala Lumpur, on dead branches, *Chipp,* 5559, 5694. Singapore, Botanic Gardens, on dead branch of Hevea brasiliensis, *Baker,* 447; on dead wood, *Sappan* 5119. Labrador Villa, on dead wood, *Chipp,* 5910.

GRANDINIA sp.

Distr:—Singapore, Blakang Mati, on dead mangrove below high tide mark, *Chipp,* 5439.

ODONTIA sp.

Distr:—Singapore, Blakang Mati, *Chipp,* 5472.

Occurs on dead mangrove and coral between low and high tide marks, forming conspicuous red and yellow patches.

HYDNUM CESATI, Berk.

Distr:—Perak, *King's collector.*

HYDNUM CRINIGERUM, Massee.

Distr:—Selangor, on dead bark, *Ridley,* 107. Perak and Singapore, *Ridley,* 28.

Hydnum duriusculum, Lloyd.

Distr:—Singapore, at the base of trees, Botanic Gardens, *E. M. Burkill,* 88; Economic Garden, *E. M. Burkill,* 345.

Hydnum elatum, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill,* 183. This specimen is considered by Lloyd to be H. ferreum.

Hydnum ferreum, Lloyd.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill,* 183. This specimen was originally determined by Massee as H. elatum.

Hydnum flavidum, Lloyd.

Distr:—Singapore, Botanic Gardens, on a dead tree, *M. Noor,* 5109.

Forming bright yellow superimposed brackets.

Hydnum glabrescens, Berk. and Rav.

Distr:—Singapore, *Beccari.*

Hydnum leptodon, Mont.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini.*

Hydnum maliense, Lloyd.

Distr:—Singapore, Botanic Gardens, *Sappan,* 5478. Bukit Timah, on the ground, *M. Noor,* 5096.

When fresh it varies in colour from deep purple to shades of grey.

Hydnum sclerodontium, Berk. and Mont.

Distr:—Selangor, Gua Batu, *Ridley,* 102. Port Swettenham, on dead wood, *M. Noor,* 4099. Kuala Lumpur, *M. Noor,* 5497. Singapore, Botanic Gardens, *Ridley,* 4916; on a dead branch of Ficus Benjamina, *E. M. Burkill,* 312; on a dead log, *Flippance,* 6198. Chua Chu Kang, *Ridley,* 46. Bukit Timah, *Ridley,* A. 7.

Commonly found on dry logs throughout the country. It is a matter for consideration as to whether this should be a species of Odontia, or as Lloyd suggests a colonial species of Pterula, or again, is it to be associated in the groups apparently contained by Echinodia ranging to some form like Polystictus aculeifer.

HYDNUM STEREOIDES, Cke.

Distr:—Perak, on logs, *King's collector,* 1660.

HYDNUM SUBTILE, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini,* 182.

HYDNUM TAPEINUM, Massee.

Distr:—Selangor, on trunks, *Ridley,* 75.

CALODON RIDLEYI, Massee.

Distr:—Singapore, on the ground, *Ridley,* 72.

IRPEX FLAVUS, Kl. Ridley, in Agric. Bull. Mal. Penin. 1897, June, 147. Bancroft, in Agric. Bull. F. M. S. i. 30, 261. Baker, in Gard. Bull. S. S ii. 112. Chipp, in Gard. Bull. S. S. ii. 187, 236, 238.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5606. Selangor, Kuala Lumpur, on a trunk, *Hashim,* 5012. On an old coffee tree killed by it, *Ridley,* 19. Singapore, Jurong, *Lim Boon Keng,* 4804. Tanglin Barracks, on dead Pterocarpus indicus, *Chipp,* 5362. Botanic Gardens, on Eugenia grandis, *Baker,* 441; on fallen limbs, *Baker,* 5315; on dead Hevea brasiliensis, *Chipp,* 4827; on dead roots of Fibraurea, *Sappan,* 5358.

A bright yellow woody fungus, considered parasitic and a cause of disease at the collar and roots of trees.

POLYPORACEAE.

MERULIUS INSIGNIS, Wakef.

Now considered as a synonym of M. similis.

MERULIUS RUFUS, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on logs, *Scortechini,* 19.

MERULIUS SIMILIS, Berk.

Distr:—Botanic Gardens, on bamboo stools, *Sappan,* 5138; *Flippance,* 6061.

When fresh this fungus is a bright yellow and orange colour, and of a consistency like fresh rubber.

PORIA CALLOSA, Fries.

Distr:—Singapore, on dead twigs, Botanic Gardens, *Ridley,* 64, 4912; Economic Gardens, *Ridley,* A. 30; *E. M. Burkill,* 291.

Poria chaetoloma, Pat.

Distr:—Singapore, Botanic Gardens, on dead limbs of Cecropia peltata, *Baker,* 5409.

Poria Epimiltium, Berk.

Distr:—Selangor, Kuala Lumpur, on a dead branch, *M. Noor,* 5587.

Lloyd mentions as synonyms P. borbonica, Pat., and P. rufotincta, Ellis.

Poria ferruginosa, Fries.

Distr:—Singapore, Botanic Gardens, on dead twigs of Cyrtophyllum fragrans, *Baker,* 5486.

Poria glaucescens, Petch.

Distr:—Singapore, Chua Chu Kang, *Ridley,* A. 29. Woodlands, *Lim Boon Keng*, 4936.

Poria hypobrunnea, Petch.

Distr:—Perak, and Selangor, on Hevea brasiliensis, *Perry*.

Poria hypolateritia, Berk. Bancroft, in Agric. Bull. F. M. S. iv. 347. South, in Agric. Bull. F. M. S. vi. 269. Chipp, in Gard. Bull. S. S. ii. 187, 235.

Specimens originally referred to this species were later determined as Fomes pseudoferreus.

Poria interrupta, Berk. and Br.

Distr:—Singapore, Tanglin Barracks, on dead Pterocarpus indicus, *Chipp,* 4678.

Poria leucoplaca, Berk.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini.*

Poria mellea, Berk. and Br.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini,* 104.

Poria Ravenalae, Berk. and Br.

Distr:—Penang, Waterfall Gardens, on dead stems of Attalea Cohune, *Burkill,* 4147. Selangor, Kuala Lumpur, on a rachis of Eugeissona tristis, *Chipp,* 5688. Singapore, *Ridley,* 70.

Poria vaporaria, Fries.

Distr:—Perak, *King's collector.*

Poria vincta, Berk.

Distr:—Perak, Gunong Batu Pateh, at 3400 feet on dead wood, *Wray*, 1216.

Poria vulgaris, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini*, 67.

Fomes annosus, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini*, 112.

Fomes applanatus, Pers.

Distr:—Penang, Waterfall Gardens, on a dead tree, *M. Noor,* 5616. Selangor, Kuala Lumpur, *M. Noor,* 5494. Singapore, Payar Lebar, on dead Cocos nucifera, *E. M. Burkill,* 326. Bukit Timah, *Chipp,* 5884. Botanic Gardens, on a rotten stump, *Chipp,* 5890. Economic Garden, on a Casuarina stump, *E. M. Burkill,* 334; on Cinnamomum iners, *A. Kadir,* 5792.

The largest of the hard woody bracket fungi. Common throughout the country.

Fomes arenosus, Cke.

Distr:—Perak, *King's collector.*

Fomes australis, Fries. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler*, 589, 590, 591, 592, 595, 606, 618. Penang, Waterfall Gardens, on stump of Albizzia Lebek, *Chipp,* 4985. Selangor, Kanching Forest Reserve, *Chipp,* 5508, 5590. Kuala Lumpur, on a Casuarina stump, *Chipp,* 5677. Singapore, Bukit Timah, on dead wood, *Chipp,* 5091, 5881, 5885. Botanic Gardens, *Ridley,* 2, 11. Without precise locality, on decaying trunks, *Scortechini,* 87.

Under this species are included the hard, heavy forms of this fungus as opposed to the lighter and more open F. applanatus.

Fomes Cacao, Pat.

Distr:—Singapore, Botanic Gardens, on rotten trunks, *Baker,* 5408.

Fomes caliginosus, Cke.

Distr:—Perak, *King's collector.*

Fomes Caryophylli, Rac.

Distr:—Singapore, Woodlands, on a dead tree, *M. Noor,* 5374. Botanic Gardens, on dead wood, *Sappan,* 5145.

Fomes conchatus, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on stems, *Scortechini,* 17.

Fomes Cornu-bovis, Cke.

Distr:—Perak, mentioned by *Ridley.*

Lloyd considers this species to be the same as Fomes melanoporus.

Fomes Curreyi, Berk.

Distr:—Perak, on stems, *King's collector.*

Lloyd considers this species the same as Trametes strigata.

Fomes diabolicus, Berk.

Distr:—Perak, *King's collector,* 1947.

Fomes fastuosus, Lev.

Distr:—Selangor, Port Swettenham, on dead mangrove below high tide level, *Chipp,* 5644.

Fomes floccosus, Bres.

Distr:—Singapore, Botanic Gardens, on a rotting log, *Baker,* 5311.

This specimen was determined by Patouillard as Trametes floccosa.

Fomes fulvus, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on stems, *Scortechini,* 85.

Fomes gibbosus, Nees.

Distr:—Selangor. Kanching Forest Reserve, *Chipp,* 5518. Singapore, Bukit Timah, on a dead log, *Chipp,* 5082. Woodlands, on dead wood, *M. Noor,* 5384, 5385.

There seems no reason to doubt that this species is an abnormal stipitate condition of the common Fomes applanatus, as suggested by Lloyd.

Fomes ignarius, Fries.

Distr:—Perak, *King's collector*. Without precise locality, on stems, *Scortechini*, 35.

Fomes introstuppeus, Berk.

Distr:—Perak, *King's collector*.

Fomes Kermes, Berk.

Distr:—Perak, *King's collector*.

Fomes lamaensis, Murr.

Distr:—Singapore, Woodlands, on a dead log, *M. Noor*, 5377.

Fomes leucophaeus, Mont.

Distr:—Singapore, Woodlands, on dead wood, *Lim Boon Keng*, 4935, *Sappan*, 5403. Economic Garden, on dead stem of Nephelium lappaceum, *Kiah*, 5722.

Fomes lignosus, Kl.

The quotations for this species here given refer to F. lignosus, although owing to an early error in determination it was at first described as F. semitostus, Sacc., and the earlier references are under that name. Gallagher, in Agric. Bull. S. and F. M. S. vii. 518. Bancroft, in Agric. Bull. F. M. S. i. 25, 141, 220, 261; and in Dep. Agric. F. M. S. Bull. No. 13. Chipp, in Gard. Bull. S. S. ii. 187, 231, 234, 235, 277, 278.

Distr:—Selangor, Kanching Forest Reserve, on dead wood, *Chipp*, 5503. Kuala Lumpur, *M. Noor*, 5491, 5492. Johore, Kukub, on fallen trees, *E. M. Burkill*, 320. Singapore, Bukit Timah, *Ridley;* Botanic Gardens, on various trees, bamboo, etc., many collections.

The well known disease of Hevea brasiliensis and jungle trees.

Fomes macer, Fries.

Distr:—Singapore, Botanic Gardens, on twigs, mentioned by *Ridley*.

Fomes marginatus, Fries.

Distr:—Perak, *King's collector*.

Fomes multiplicatus, Mont.

Distr:—Selangor, Kuala Lumpur, *M. Noor*, 5493, 5585.

FOMES NIGRO-LACCATUS, Berk.

Distr:—Selangor, *Ridley*, 121. Pahang, *Barnes.* Johore, Pengerang, *Cassim*, A. 28. Singapore, Botanic Gardens, *Ridley;* on dead wood, *Kiah*, 5732. Economic Garden, on dead wood, *Kiah*, 5723.

FOMES OBLIQUUS, Fries.

Distr:—Perak, *King's collector,* Without precise locality, growing over branches, *Scortechini.*

FOMES PACHYPHLOEUS, Pat.

Distr:—Selangor, Kuala Lumpur, *M. Noor*, 5563.

FOMES PHAEOPLACUS, Pat.

Dist:—Singapore, Botanic Gardens, on a rotting log, *Baker*, 424.

FOMES POMACEUS, Pers.

Distr:—Penang, Waterfall Gardens, *M. Noor*, 5597.

FOMES PSEUDO-FERREUS, Wakf. Belgrave, in Dep. Agric. F. M. S. Bull. No. 28. Chipp, in Gard. Bull. S. S. ii. 187, 235.

A "wet rot" of Hevea brasiliensis, at first described as Poria hypolateritia.

FOMES RHYTIPHLAEUS, Mont.

Distr:—Perak, *King's collector.* Without precise locality, on stems, *Scortechini*, 88, 89.

FOME ROBUSTUS, Kars.

Distr:—Kedah, Gunong Jerai, *M. Noor*, 5202. Singapore, Woodlands, on dead wood, *M. Noor* ,5379.

FOMES SENEX, Nees.

Distr:—Perak, *King's collector.* Penang, *Curtis*, 2189. Johore, Johore Bharu, on dead wood, *M. Noor*, 5853. Singapore, Woodlands, on dead wood, *M. Noor*, 5386, 5837; Bukit Timah, on dead wood, *Chipp*, 5867.

FOMES SUBSTYGIUS, Berk.

Distr:—Perak, *King's collector.*

FOMES SUBTORNATUS, Murr.

Distr:—Singapore, Woodlands, on a dead log, *M. Noor*, 5389. Government House Grounds, on stem of living Albizzia moluccana, *Flippance*, 6153.

FOMES SULCATUS, Cke.

Distr:—Perak, *King's collector.* Without precise locality, on stems, *Scortechini.*

FOMES THWAITESII, Berk.

Distr:—Perak, *King's collector.*

GANODERMUS AMBOINENSIS, Fries. Bancroft, in Agric. Bull. F. M. S. i. 261.

Distr:—Singapore, *Beccari;* Chua Chu Kang, *Ridley,* 45. Lloyd considers this the same as G. dorsalis of the "lucidus" group.

VAR. COCHLEARIS, Nees. Without precise locality, on stems and branches, *Scortechini,* 46.

GANODERMUS COLOSSUS, Fries.

Distr:—Singapore, Botanic Gardens, on dead Ficus Benjamina, *Baker,* 425.

GANODERMUS DORSALIS.

Distr:—Singapore, Botanic Gardens, on a log, *E. M. Burkill,* 310.

GANODERMUS LACCATUS, Zoll.

Distr:—Singapore, Botanic Gardens, on a fallen trunk, *Baker,* 5131.

GANODERMUS LUCIDUS, Ley. South, in Agric. Bull. F. M. S. vi. 269. Chipp, in Gard. Bull. S. S. ii. 197, 280.

Distr:—Penang, *Curtis,* 20*a*. Perak, *Kunstler.* Selangor, Kuala Lumpur, *Chipp,* 5673. Singapore, Tanjong Katong, on a dead stem of Cocos nucifera, *E. M. Burkill,* 179: Watten, *Flippance,* 6011. Without precise locality, on branches, *Scortechini,* 76.

A common stipitate form also occurs:—

Distr:—Selangor, Kuala Lumpur, *M. Noor,* 5498. Singapore, Tanglin Barracks, on dead Pterocarpus indicus, *Chipp,* 4677, 4679, 5658.

GANODERMUS MANGIFERAE, Lev.

Distr:—Singapore, Bedok, on a dead tree Cocos nucifera, *Burkill,* 107.

GANODERMUS MASTOPORUS, Lev.

Distr:—Penang, Waterfall Gardens, *M. Noor,* 5601. Singapore, Botanic Gardens, on a rotting log, *Baker,* 5321.

GANODERMUS OCHROLACCATUS, Bres.

Distr:—Selangor, Port Swettenham, on dead mangrove, *Chipp*, 5642.

POLYPORUS ABRUPTUS, Berk.

Distr:—Perak, *King's collector*. Perak and Singapore, *Ridley*, 130. Singapore, Woodlands, on dead wood, *M. Noor*, 5392.

POLYPORUS ACERVATUS, Lloyd.

Distr:—Singapore, Woodlands, on dead wood, *M. Noor*, 5391. A cream coloured fungus, growing in superimposed brackets. Lloyd places it next to Polyporus grammocephalus.

POLYPORUS ADUSTUS, Fries.

Distr:—Singapore, Woodlands, on dead bark, *Sappan*, 5410.

POLYPORUS AFFINIS, Nees. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler*, 629.

POLYPORUS ALBELLUS, Massee.

Distr:—Selangor, *Ridley*, 24, 80.

POLYPORUS ALVEOLARIS, Fries.

Distr:—Perak, *King's collector*, 4863.

POLYPORUS ANEBUS, Berk.

Distr:—Singapore, Pasir Panjang, on a dead trunk, *Burkill*, 106. Botanic Gardens, on dead logs of Ficus Benjamina, *Burkill*, A. 3; *E. M. Burkill*, 170.

POLYPORUS ARATUS, Berk. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor*, 5612. Perak, *Kunstler*, 617.

POLYPORUS ARENOSUS, Cke. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, Gopeng, on logs lying on sandy ground, *Kunstler*, 631.

POLYPORUS ARCULARIUS, Fries.

Distr:—Selangor, on rotten wood, *Ridley*, 31.

Polyporus ater, Lloyd.

Distr:—Singapore, Woodlands, on dead wood, *M. Noor,* 5383. Distinguished by its completely black colour.

Polyporus auberianus, Mont. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 615, 643.

Polyporus biogilvus, Lloyd.

Distr:—Singapore, Bukit Timah, on a dead log, *Chipp,* 5092. A small straw coloured, fan shaped fungus.

Polyporus blanchetianus, Mont.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini,* 146.

Polyporus brunneo-pictus, Berk. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 629.

Lloyd considers that the Malay specimens named as this species by Cooke, should be Polystictus brunneo-maculatus.

Polyporus caliginosus, Mont. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 596.

Polyporus carneo-fulvus, Berk.

Distr:—Penang, Waterfall Gardens, *M. Noor,* 5619. Lloyd considers this species to be but a colour form of Polyporous gilvus, Fries.

Polyporus chrysites, Berk.

Distr:—Perak, *Kunstler,* 3837.

Polyporus cinerascens, Ces. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 625.

Polyporus cingulatus, Berk. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 597.

Polyporus cochleariformis, Cke.

Distr:—Perak, on logs, *King's collector,* 2821.

POLYPORUS CORNU-BOVIS, Cke. Bancroft, in Aric. Bull. F. M. S. i. 262.

Distr:—Perak, Goping, on rotten logs, *Kunstler,* 595.

POLYPORUS CYSTIDIOIDES, Lloyd.

Distr:—Singapore, Botanic Gardens, on bark, *Sappan,* 5357.

POLYPORUS DICHROUS, Fries.

Distr:—Singapore, Economic Garden, *Ridley,* A. 31. Botanic Gardens, on fallen limbs, *Baker,* 5130.

POLYPORUS DICTYOPUS, Mont.

Distr:—Malacca, Ayer Keroh, *Ridley,* 157.

POLYPORUS DIMORPHUS, Cke.

Distr:—Perak, *Kunstler,* 644.

POLYPORUS DURUS, Jungh.

Distr:—Kedah, Gunong Jerai, *M. Noor,* 5219. Selangor, Kanching Forest Reserve, on dead wood, *Chipp,* 5509, 5511. Singapore, on dead wood, Bukit Timah, *Chipp,* 5086. Botanic Gardens, *Chipp,* 4911; *Kiah,* 5733.

POLYPORUS EMERICI, Berk.

Distr:—Singapore, Botanic Gardens, on dying branches of Ficus Benjamina, *E. M. Burkill*, 332.

Considered by Lloyd to be a large-pored form of Polyporus grammocephalus.

POLYPORUS FLAVUS, Jungh.

Distr:—Singapore, Botanic Gardens, *Baker,* 5315.

POLYPORUS GILVUS, Fries.

Distr:—Perak, *King's collector.* Singapore, Dalvey Road, on stems of Nephelium lappaceum, *Kiah,* 5714. Tanglin Barracks, on branch of living Terminalia Catappa, *Chipp,* 4811. Blakang Mati, on dead mangrove below high tide mark, *Chipp,* 5473. Botanic Gardens, on a dead log, *M. Noor,* 5136; on a dead stem of Castanopsis, *Chipp,* 5891. Without precise locality, on branches, *Scortechini.*

This fungus often appears as brown sheets covering wounded portions of a living stem. It may prove to be a parasite.

POLYPORUS GRAMMOCEPHALUS, Berk. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Penang, *Beccari*. Perak, *King's collector*, 3836, 2989, 1107, 4134. Selangor, Kuala Lumpor, *Belgrave*, 4940. Singapore, Mandai Road, *Chipp*, 5826. Botanic Gardens, *Ridley*, 145, 146; *Sappan*, 5116, 5353, 5422; *Baker*. Economic Gardens, *Kiah*, 5725.

Common on dead logs.

Cooke also quotes the following records for *King's collector* in

Perak:—

V. EMERICI, Berk. 739, 3441, 3442, 3444.
V. RUSSICEPS, Berk. 4257.
V. MACULATUS, Curt. 3343.

POLYPORUS HEMICAPNODES, Berk.

VAR. DIMORPHUS, Cke. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, Goping, on dead logs, *King's collector*, 665.

POLYPORUS HIRSUTUS, Pers. Bancroft, in Agric. Bull. F. M. S. i. 150, 220, 262. Baker, in Gard. Bull. S. S. ii. 112. Chipp, in Gard. Bull. S. S. ii. 197, 280.

Common on dead logs everywhere.

POLYPORUS HOOKERI, Berk.

Distr:—Singapore, Botanic Gardens, on a dead log, *M. Noor*, 5137.

POLYPORUS INCURVUS, Cke. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, Goping, *King's collector*, 610.

POLYPORUS INFLEXIBILIS, Berk.

Distr:—Perak, *Kunstler*, 627.

POLYPORUS INTROSTUPPEUS, Berk. and Cke. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, on jungle trees, *Kunstler*, 587.

POLYPORUS IOBAPHUS, Pat.

Distr:—Singapore, Botanic Gardens, on rotting logs, *Baker*, 472.

POLYPORUS KERMES, Berk. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler*, 601.

Polyporus lichnoides, Mont.

Distr:—Singapore, Bukit Timah, on a dead log, *Chipp*, 5098.

Polyporus occidentalis, Kl. Ridley, in Agric. Bull. S. and F. M. S. vii. 230. Fox, in Agric. Bull. S. and F. M. S. ix. 133. Bancroft, in Agric. Bull. F. M. S. i. 150, 220, 262. Chipp, in Gard. Bull. S. S. ii. 197. (under Polystictus) 233.

Common on dead wood throughout the country.

Polyporus ochroleucus, Berk.

Distr:—Perak, *King's collector.* Without precise locality, on stems, *Scortechini.*

Polyporus ostreiformis, Berk.

Distr:—Selangor, Port Swettenham, on dead mangrove below high tide mark, *Chipp,* 5639.

Polyporus phaeodermus, Pat.

Distr:—Singapore, Botanic Gardens, on a rotting trunk, Baker, 5412.

Polyporus Ravenalae, R. Br.

Distr:—Singapore, *Beccari.*

Polyporus retro-ater, Lloyd.

Distr:—Selangor, Kanching Forest Reserve, on bark, *Chipp,* 5650.

Polyporus rhombiporus, Pat.

Distr:—Singapore, Botanic Gardens, on a stump, *Baker*, 480.

Polyporus rubidus, Berk.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5593. Perak, *King's collector.* Selangor, Kuala Lumpor, on dead wood, *M. Noor,* 5558. Johore Bahru, *M. Noor,* 5856. Singapore, Woodlands, on dead wood, *M. Noor,* 5390; *Sappan*, 5408. Without precise locality, on stems, *Scortechini,* 156.

Easily recognised by its pale pink colour, though some forms approximate in colour to Fomes lignosus and have in the field at first been taken for that species.

Polyporus rufo-flavus, Berk. and Curt.

Distr:—Singapore, *Beccari.*

Polyporus rugosus, Nees.

Very commonly distributed throughout the country, generally found growing on the ground, the base of the stipe attached to rootlets. The pore surface is pure white and forms a sharp contrast to the uniform black of the rest of the fungus. When the pore surface is bruised or scratched it quickly reddens. Lloyd considers that the reference of these Malayan specimens should rather be to P. Ramosii, Murr. owing to their thin and comparatively slender structure.

Polyporus rugulosus, Jungh. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, Botanic Gardens, on rotting trunks, *Baker,* 5305.

Polyporus scopulosus, Berk.

Distr:—Singapore, Botanic Gardens, *E. M. Burkill,* 170; *Flippance,* 5646.

Sometimes shown as a species of Fomes or Trametes, and occasionally under the specific name of "rhizophorae."

Polyporus scruposus, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on stems. *Scortechini,* 63.

Polyporus Senex, Berk. and Mont. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 588, 594.

Polyporus Sepia, Lloyd.

Distr:—Singapore, Ponggul, on a dead coconut tree, *Burkill,* 105. Botanic Gardens, *Ridley,* A. 24; on the stem of a living Albizzia, *E. M. Burkill,* 129; on logs of Ficus Benjamina, *E. M. Burkill,* 169.

Polyporus Spongia, Fries. Sharples, in Agric. Bull. F. M. S. ii. 84.

Distr:—Selangor, Kuala Lumpor, at the base of a dead stump, *Sharples.*

Polyporus suberianus, Mont.

Distr:—Perak, *King's collector.*

Polyporus sulfureus, Fries.

Distr:—Singapore, Botanic Gardens, *Baker.* 5194.

POLYPORUS THEOBROMAE, Lloyd .

Distr:—Singapore, Blakang Mati, on dead mangrove below high tide mark, *Chipp*, 5441.

Lloyd suggests that this may be another link in a series of development exampled by Echinodia, P. Theobromae, Hydnum sclerodontium, and Polystictus aculeifer.

POLYPORUS THWAITESII, Berk. and Br. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler*, 642.

POLYPORUS UNGULATUS, Bull.

Distr:—Penang, *Beccari*.

POLYPORUS VIBECINUS, Fries.

Distr:—Perak, *King's collector*. Without precise locality, on trunks and branches, *Scortechini*, 47.

POLYPORUS VULNERATUS, Lev.

Distr:—Singapore, Botanic Gardens, on a rotting log, *Baker*, 5320.

POLYPORUS WILLIAMSII, Merr. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, Botanic Gardens, on a stump of Hevea brasiliensis, *Baker*, 5423.

POLYPORUS ZONALIS, Berk.

Distr:—Selangor, Kuala Lumpor, *Belgrave*, 4992. Singapore, Botanic Gardens, on a jungle stump, *E. M. Burkill*, 184.

ECHINODIA THEOBROMAE, Pat. Burkill, in Gard. Bull. S. S. ii. 144. Chipp, in Gard. Bull. S. S. ii. 199.

Distr:—Kedah, Gunong Jerai, *M. Noor*, 5211. Singapore, Botanic Gardens, on a dead limb of Theobroma Cacao, *Baker*, 5410; on dead wood, *E. M. Burkill*, 314; on a dead branch of a Quercus, *Ahmat*, 5143; *Chipp*, 5735; *Burkill*, 6151.

See remarks under Hydnum sclerodontium.

POLYSTICTUS ACULEANS, Berk.

Distr:—Perak, *King's collector.* Singapore, *Chipp,* 4924. Without precise locality, on stems, *Scortechini,* 66.

In determining specimen 4924, which is the only one of the above he definitely assigns to this species, Lloyd remarks "Is it not strange, illustrating the sporadic occurrence of fungus species, that this plant which was found in Brazil sixty five years ago by Spruce was re-collected for the first time in Malay only in 1919?"

POYLSTICTUS ACULEIFER, Berk.

Distr:—Singapore, Botanic Gardens, on a dead log, *Sappan,* 5066.

See remarks under Hydnum sclerodontium. This is the first record for this species outside the American tropics.

POLYSTICTUS ALBOBADIUS, Lloyd.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5603.

POLYSTICTUS ALBOCERVINUS, Sacc.

Distr:—Selangor, *Ridley,* 119.

POLYSTICTUS ANOMALOSUS, Lloyd.

Distr:—Singapore, Botanic Gardens, *Ridley,* A. 26.

POLYSTICTUS BADIUS, (Berk).

Distr:—Selangor, Kanching Forest Reserve, on dead wbod, *Chipp,* 5512.

Lloyd suggests that this specimen might be considered as a "var. microporus," owing to its smaller pores.

POLYSTICTUS BASIPHAEUS, Sacc. and Paol.

Distr:—Without precise locality, on stems, *Scortechini,* 27.

POLYSTICTUS BICOLOR, Lloyd.

Distr:—Singapore, Botanic Gardens, on bark, *Sappan,* 5352.

POLYSTICTUS BRUNNEO-MACULATUS, Currey.

Distr:—Singapore, Economic Garden, on a dead log, *A. Kadir,* 5414.

POLYSTICTUS CAPERATUS, Berk.

Distr:—Singapore, Botanic Gardens, *Ridley,* 60; on dead wood, *Sappan,* 5126, 5423; *Kiah,* 5738.

POLYSTICTUS CERVINO-GILVUS, Jungh.

Distr:—Singapore, Blakang Mati, on dead mangrove below high tide mark, *Chipp*, 5435.

POLYSTICTUS CICHORACEUS, Berk.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor*, 5605. Perak, *King's collector*. Singapore, Botanic Gardens, on dead wood, *Sappan*, 5148. Without precise locality, on branches, *Scortechini*.

POLYSTICTUS CINNAMOMEUS, Fries.

Distr:—Singapore, Botanic Gardens, about the roots of Cyrtophyllum fragrans, *E. M. Burkill*, 270.

POLYSTICTUS CRENATUS, Berk.

Distr:—Singapore, on dead logs, Bukit Timah, *Chipp*, 5100; Botanic Gardens, *M. Noor*, 5130.

It is difficult to separate this species from P. pterygodes, Fr., and some authorities consider these two specimens should be placed under that species.

POLYSTICTUS CRISTATUS, Cke.

Distr:—Singapore, Woodlands, on dead wood, *M. Noor*, 5382.

POLYSTICTUS CUPROROSEUS, Berk.

Distr:—Perak, *King's collector*, 1867.

POLYSTICTUS DERMATODES.

Distr:—Singapore, Botanic Gardens, *Ridley*, 22. Originally determined as Hexagona pergamenea, but referred to above species on Lloyd's authority.

POLYSTICTUS DILATATUS, Berk.

Distr:—Perak, *Kunstler*, 2799.

POLYSTICTUS DISCIPES, Berk.

Distr:—Perak, *Kunstler*, 3913, 4135.

See also under Polystictus maliensis.

POLYSTICTUS ELONGATUS, Sacc.

Distr:—Perak, *King's collector*, 3665. Selangor, *Ridley*, 109. Singapore, Botanic Gardens, *Ridley*, 138.

Polystictus Feei, Fries.

Distr:—Singapore, Botanic Gardens, *Ridley,* 144. Without precise locality, on decaying branches, *Scortechini,* 69.

Polystictus flabelliformis, Fries. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Penang, *Beccari.* Perak, *Kunstler,* 637, 640. Perak and Singapore, *Ridley,* 65, 103, 112. Singapore, Kranji, on a dead stick, *Chipp,* 6003. Bukit Timah, on a dead branch, *Chipp,* 5877. Botanic Gardens, on a fallen branch, *E. M. Burkill,* 138; *Husein,* 5532; *Sappan,* 5421.

Commonly recorded throughout the country.

Polystictus floridanus, Sacc. Bancroft, in Agric. Bull. F. M. S. i. 150. Chipp, in Gard. Bull. S. S. ii. 197, 280.

Distr:—Selangor, *Ridley,* 114.

Polystictus gallo-pavonis, Berk.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan,* 5361.

Polystictus kurzianus, Cke.

Distr:—Singapore, Botanic Gardens, on a dead log of Ficus Benjamina, *E. M. Burkill,* 319.

Polystictus latus, Berk.

Distr:—Perak, *King's collector,* 740. Selangor, *Ridley,* 93. Singapore, *Ridley,* 23, 26.

Polystictus lilacino-gilvus, Sacc.

Distr:—Selangor, *Ridley,* 101, 108; Batu Caves, *Ridley,* 100.

Polystictus lutescens, Pers.

Distr:—Perak, *King's collector.* Without precise locality, on decaying stems, *Scortechini,* 5, 111.

Polystictus luteus, Bl. and Nees.

Distr:—Perak, *Kunstler.* Without precise locality, on stems and branches, *Scortechini,* 84.

Polystictus malaccensis, Cke.

Distr:—Perak, *Kunstler.*

Polystictus maliensis, Cke.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor*, 5622. Perak, on logs, *King's collector,* 5398. Singapore, Botanic Gardens, on a dead log, *M. Noor,* 5135. Economic Garden, *Chipp,* 4814.

Specimens 5135 and 5622 are considered at Kew to belong to the closely allied species P. discipes. Lloyd considers they might be named P. aratoides if that species can be considered to be distinct from P. maliensis.

Polystictus membranaceus, Sacc.

Distr:—Selangor, *Ridley,* 92.

Polystictus Menziesii, Cke.

Distr:—Singapore, *Ridley,* 37.

Polystictus microcyclus, Zipp.

Distr:—Perak, *Kunstler,* 910. Singapore, *Ridley,* 132.

Polystictus molliusculus, Berk.

Distr:—Singapore, Botanic Gardens, *Ridley,* 38.

Polystictus mutabilis, Berk. and Curt. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini.*

Polystictus nilgherrensis, Mont.

Distr:—Perak, *Kunstler,* 2001.

Polystictus obovatus, Jungh.

Distr:—Singapore, Botanic Gardens, *Ridley,* 55. Determined by Massee as P. licmophorus, which is considered by Lloyd to be a dark form of this species.

Polystictus pallidus, Berk.

Distr:—Selangor, Kuala Lumpor, *M. Noor,* 5561.

Polystictus perennis, Fries.

Distr:—Perak, *Kunstler.*

Polystictus Persoonii, Cke.

See under Trametes Persoonii.

Polystictus pterygodes, Fries.

See under Polystictus crenatus.

Polystictus Ridleyi, Massee.

Distr:—Malacca, Ayer Keroh, *Ridley,* 149.

Polystictus rigescens, Cke.

Distr:—Perak, on rotting logs, *King's collector,* 4818.

Polystictus sacer, Fries.

Distr:—Perak, *King's collector,* 911, 1822. Singapore, *Ridley,* 36.

Polystictus sanguineus, Fries. Bancroft, in Agric. Bull. F. M. S. i. 262. Chipp, in Gard. Bull. S. S. ii. 190.

One of the commonest woody fungi, occurring everywhere on dead wood and easily noticeable from its bright scarlet colour.

Polystictus Sector, Fries.

Distr:—Singapore, Botanic Gardens, *Ridley,* 62.

var. cubicola, Berk.

Distr:—Without precise locality, on branches, *Scortechini,* 150.

Polystictus squamaeformis, Berk.

Distr:—Perak, *King's collector,* 3682. Singapore, Botanic Gardens, *Ridley,* 61.

Polystictus stereinus, Berk. and Curt. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Penang, Maxwell Hill, at 3000 feet, on dead wood, *Curtis, 20c.*

Polystictus submembranaceus, Berk. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 613.

Polystictus subpellucidus, Sacc.

Distr:—Selangor, *Ridley,* 98.

Polystictus substygius, Berk. and Br. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 633.

POLYSTICTUS TABACINUS, Mont.

Distr:—Perak, *King's collector.* Selangor, Kanching Forest Reserve, *Chipp,* 5516. Without precise locality, on dying stems, *Scortechini*, 39, 54, 90.

Lloyd considers that specimen 5516 might be referred to P. substygius.

POLYSTICTUS VERSICOLOR, Fr.

Distr:—Perak, *Kunstler.* Without precise locality on stems, *Scortechini*, 52, 111, 123, 178.

POLYSTICTUS VINOSUS, Berk.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5608. Perak, *King's collector,* 2143. Singapore, Botanic Gardens, *Ridley*, 26, 59.

POLYSTICTUS VIRGINEUS, Fries.

Ditsr:—Perak, *Kunstler.* Without precise locality, on dead branches, *Scortechini*, 128.

POLYSTICTUS XANTHOPUS, Fries. Bancroft, in Agric. Bull. F. M. S. i. 262.

One of the most widely distributed fungi, growing on dead wood.

POLYSTICTUS XERAMPELINUS, Sacc. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Singapore, Botanic Gardens, *Ridley,* 12.

TRAMETES BADIA, Berk.

Distr:—Singapore, Woodlands, on dead wood, *Sappan,* 5405. Botanic Gardens, *Baker,* 492.

Specimen 5405 is doubtfully referred to this species by Lloyd.

TRAMETES CINGULATA, Berk.

Distr:—Perak, *King's collector,* 3088.

TRAMETES CORRUGATA, Bres.

See under T. Persoonii.

TRAMETES CURREYI, Cke.

Distr:—Perak, *King's collector.*

TRAMETES FLOCCOSA, Bres.

Distr:—Singapore, Botanic Gardens, on rotting logs, *Baker,* 5311.

TRAMETES LACHNEA, Berk. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, on fallen limbs of Hevea brasiliensis, *Baker.*

TRAMETES LACTINIA, Berk.

Distr:—Singapore, Woodlands, on dead wood, *Sappan,* 5406. Botanic Gardens, on a fallen trunk, *Baker,* 5192.

TRAMETES LOBATA, Berk.

Distr:—Perak, *King's collector,* 4600, 5774.

TRAMETES MARCHIONICA, Lev.

Distr:—Singapore, Botanic Gardens, on a dead branch of a Ficus, *E. M. Burkill,* 105. *Chipp,* 5250.

TRAMETES MEYNII, Kl.

Distr:—Johore, Johore Bahru, on dead wood, *M. Noor,* 5859. Singapore, Economic Garden, on a dead Casuarina, *Sappan,* 5366.

Lloyd gives the following synonyms for this species, Polystictus obstinatus, Cke. and Trametes cornea, Pat.

TRAMETES MUELLERI, Berk.

Distr:—Selangor, Kuala Lumpor, on a Casuarina stump, *Chipp,* 5676. Singapore, Economic Garden, *Chipp,* 4838.

TRAMETES OCCIDENTALIS, Fries.

Distr:—Perak, *Kunstler,* 605, 614, 619.

TRAMETES PERSOONII, Mont. Baker, in Gard. Bull. S. S. ii. 112. One of the commonest fungi, to be found everywhere on dead logs.

TRAMETES PUNICEA, Fries.

Distr:—Perak, *King's collector.* Penang, on branches, *Scortechini,* 177.

TRAMETES RIGIDA, Berk. Bancroft, in Agric. Bull. F. M. S. i. 262.
Distr:—Perak, *Kunstler,* 608.

TRAMETES SERICEA.

Distr:—Selangor, Kuala Lumpor, *Ridley,* 165.

TRAMETES SERPENS, Fries.

Very common everywhere on dead branches and twigs.

TRAMETES TRANSMUTANS, Lloyd.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan*, 5364.

As Lloyd suggests, this is quite possibly a derivative of Lenzites repanda.

TRAMETES VERSATILIS, Berk.

Distr:—Perak, *King's collector*, 1239, 4607. Singapore, on dead wood, Woodlands, *M. Noor*, 5371. Napier Road, *Sappan*, 5370. Bukit Timah, *Chipp*, 5093, 5865, 5889.

DAEDALEA ANDAMANICA, Berk.

Distr:—Perak, on trunks, *King's collector*, 4161.

DAEDALEA FLAVIDA, Lev.

Distr:—Johore, Johore Bahru, Causeway Works, *Chipp*, 5857. Singapore, Woodlands, on dead wood, *M. Noor*, 5388. Economic Garden, on dead Casuarina, *Sappan*, 5365; on dead wood, *Flippance*, 5924.

Specimens of this affinity are most variable, and according to Lloyd may be placed under any one of seventeen different names, according to the form taken by the hymenium.

DAEDALEA INTERMEDIA, Berk.

Distr:—Singapore, Botanic Gardens, on dead timber, *Ridley*, 65.

DAEDALEA LENZITIFORMIS, Ces.

Distr:—Penang, *Beccari*. Perak, *King's collector*. Without precise locality, on stems, *Scortechini*, 15.

DAEDALEA RIDLEYI, Lloyd.

Distr:—Singapore, Bukit Timah, *Ridley*, 4920.

DAEDALEA SANGUINEA, Kl. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Penang, *Beccari*. Perak, *Kunstler*, 605.

DAEDALEA SUBCONGENER, Berk.

Distr:—Penang, *Curtis*, 2196.

LENZITES ALBIDA, Fries.

Distr:—Perak, *King's collector*.

LENZITES APPLANATA, Fries.

Distr:—Perak, *Kunstler,* 598, 599. Selangor, common on rotten trees, Gua Batu, *Ridley,* 87.

LENZITES BETULINA, Fries.

Distr:—Without precise locality, on branches, *Scortechini,* 121.

LENZITES DEPLANATA, Fries.

Distr:—Perak, *King's collector,* 4727.

LENZITES MALACCENSIS, Sacc. and Cub.

Distr:—Without precise locality, on stems, *Scortechini,* 140.

LENZITES PALISOTI, Fries.

Distr:—Singapore, Botanic Gardens, on dead wood, *Baker,* 5308; *Chipp,* 4817, 5843.

LENZITES PLATYPHYLLA, Cke. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Perak, Goping, on rotting wood, *King's collector,* 607, 4512.

This name is considered at Kew as a synonym for L. malaccensis.

LENZITES PLATYPHYLLA, Lev.

Distr:—Selangor, on dead wood, *Ridley,* 26, 85, 91; Gua Batu, *Ridley,* 88. Singapore, Economic Garden, on a dead log, *Chipp,* 5417.

LENZITES REPANDA, Mont.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5607. Selangor, Kuala Lumpur, *M. Noor,* 5490. Singapore, Bukit Timah, *Chipp,* 5088. Botanic Gardens, *Sappan,* 5363; *Flippance,* 6173. Economic Garden, on a dead stem of Hevea brasiliensis, *Chipp,* 5749; *Flippance,* 5923.

Common on dead wood. Generally an ivory white colour but sometimes cream.

HEXAGONIA ALBIDA, Berk.

Distr:—Penang, Waterfall Gardens, on dead Albizzia, *M. Noor,* 5592. Singapore, on dead wood, Botanic Gardens, *Ridley,* A. 39, 153; *E. M. Burkill,* 271, 275, 297, 305. Napier Road, *Sappan,* 5368.

At Kew specimen 5368 was determined as H. macrotrema.

HEXAGONIA ANGULATA, Lloyd.

Distr:—Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5604.

HEXAGONIA CERVINO-PLUMBEA, Jungh. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, Botanic Gardens, on limbs of Hevea brasiliensis, *Baker,* 435.

HEXAGONIA CUCULLATA, Mont.

Distr:—Singapore, Botanic Gardens, on the ground, *Sappan,* 5483.

HEXAGONIA DURISSIMA, Berk.

Distr:—Singapore, Botanic Gardens, *Ridley,* A. 25; on dead logs, *E. M. Burkill,* 93; *M. Noor,* 5110.

A black resinous heavy fungus with white pore mouths, and as hard as iron.

HEXAGONIA FLAVIDA, Lev.

Distr:—Singapore, Bukit Timah, on a dead log, *Chipp,* 5075.

Lloyd remarks that this is one of the many hymenial forms of Daedalea flavida.

HEXAGONIA POLYGRAMMA, Mont. Chipp, in Gard. Bull. S. S. ii. 232.

The specimen here referred to has since been determined as H. umbrosus. The species typically "polygramma" does not appear to have been collected in Malay so far.

HEXAGONIA PULCHELLA, Lev. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, on dead branches, Botanic Gardens, *Baker,* 436; *E. M. Burkill,* 104, 321.

HEXAGONIA SUBACULEATA, Ces.

Distr:—Johore, *Beccari.*

HEXAGONIA TENUIS, Hook. Bancroft, in Agric. Bull. F. M. S. i. 262. A. L. Smith, in Journ. F. M. S. Museums, ii. 142.

Distr:—Penang, *Curtis,* 2187, 2197. Perak, *King's collector,* 3342. Pahang, Gunong Tahan, at 3300 feet, on dead wood, *Wray and Robinson.* Singapore, Mandai Road, on dead branches, *Chipp,* 5804. Botanic Gardens, *Ridley,* 143; *M. Noor,* 5521. Economic Garden, *Ridley,* A. 20; *Kiah,* 5726.

HEXAGONIA THWAITESII, Berk. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, on dead limbs of Hevea brasiliensis, *Baker.*

HEXAGONIA TRICOLOR, Fries.

Distr:—Selangor, Kuala Lumpur, *M. Noor,* 5569.

According to Lloyd H. discopoda, Pat. is the same species.

HEXAGONIA UMBROSA, Lloyd.

Distr:—Pahang, Pekan, collector not stated. Selangor, Port Swettenham, on dead mangrove below high tide mark, *Chipp,* 5634. Singapore, Jurong, on an old tree of Artocarpus integrifolia, *Ridley,* A. 21. Blakang Mati, on dead mangrove below high tide mark, *Chipp,* 5460. Botanic Gardens, *Ridley,* 141; *Chipp,* 5784.

LASCHIA AGARICINA, Pat.

Distr:—Singapore, Botanic Gardens, on dead twigs, *E. M. Burkill,* 277, part.

LASCHIA CAESPITOSA, Berk.

Distr:—Selangor, on dead wood, *Ridley,* 12, 25, 32. Without precise locality, on stems, *Scortechini.*

LASCHIA CHIPPII, Lloyd.

Distr:—Penang, Waterfall Gardens, on dead palm stems, *Chipp,* 4698.

LASCHIA DELICATULA, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on dead wood, *Scortechini.*

LASCHIA SIMILIS, Lloyd.

Distr:—Singapore, Bukit Timah, on a dead log, *Chipp,* 5084.

LASCHIA TREMELLOSA, Fries.

Distr:—Perak, *King's collector.*

FAVOLUS ALUTACEUS, Berk. and Mont.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini.*

FAVOLUS BOUCHEANUS, Kl.

Distr:—Singapore, *Ridley,* 161.

FAVOLUS BRASILIENSIS, Fries. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Upper Perak, on dead wood, *Bancroft.*

FAVOLUS FLACCIDUS, Fries.

Distr:—Perak, *King's collector.* Without precise locality, on dead logs, *Scortechini,* 53.

FAVOLUS MOLLUCCENSIS, Mont.

Distr:—Perak, *King's collector.* Singapore, Botanic Gardens, on dying branches of Ficus Benjamina, *E. M. Burkill,* 331. Without precise locality, on decaying logs, *Scortechini,* 117.

FAVOLUS PUXILLUS, Fries.

VAR. PALLIDIPES.

Distr:—Perak, *King's collector.* Without precise locality, on logs, *Scortechini.*

FAVOLUS RUFICEPS, Berk. and Br.

Distr:—Singapore, Botanic Gardens, on wood, *Ridley.*

FAVOLUS SCABER, Berk. and Br. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Perak, *Kunstler,* 639. Selangor, on dead wood, *Ridley,* 30.

VAR. FUSCA, Ces.

Distr:—Singapore, *Beccari.*

FAVOLUS SPATHULATUS, Jungh. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, Botanic Gardens, on dead limbs of Hevea brasiliensis, *Baker,* 5420. Economic Garden, on stem of Hevea brasiliensis, *Sappan,* 5431.

FAVOLUS TESSELLATUS, Mont.

Distr:—Perak, *King's collector,* 1192. Selangor, Kuala Lumpor, *Chipp,* 5700. Singapore, Bukit Timah, *Ridley,* A. 27. Botanic Gardens, on dead wood, *E. M. Burkill,* 278; *Sappan,* 5115.

CYCLOMYCES FUSCUS, Fries.

Distr:—Kedah, Gunong Jerai, *M. Noor,* 5203. Perak, *King's collector,* 4341. Penang, Waterfall Gardens, on dead wood, *M. Noor,* 5598. Malacca, Ayer Keroh, *Ridley,* 152.

Cyclomyces stereoides, Sacc. and Paol.

Distr:—Perak, *King's collector.* Without precise locality, on branches, *Scortechini.*

Boletus albellus, Massee.

Distr:—Singapore, *Ridley,* 11. ser. 2.

Boletus altissmus, Massee.

Distr:—Singapore, *Ridley,* 9 ser. 2.

Boletus Alwisii, Massee.

Distr:—Singapore, *Ridley,* 42, 95 ser. 2.

Boletus aureo-mycetinus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 4993.

Boletus bicolor, Massee.

Distr:—Singapore, *Ridley,* 56 ser. 2.

Boletus craspedius, Massee.

Distr:—Singapore, Gardens' Jungle, on the ground, *E. M. Burkill,* 137.

Boletus cyanopus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 5006.

Boletus flavipes, Massee.

Distr:—Singapore, *Ridley,* 25 ser. 2.

Boletus flexipes, Massee.

Distr:—Singapore, *Ridley,* 97 ser. 2.

Boletus funerarius, Massee.

Distr:—Singapore, *Ridley,* 50 ser. 2.

Boletus icterinus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 4991.

Boletus indecorus, Massee.

Distr:—Singapore, Gardens' Jungle, on tree roots, *E. M. Burkill,* 66, 147.

Boletus longipes, Massee.

Distr:—Singapore, *Ridley,* 81 ser. 2.

Boletus malaccensis, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 5004.

Boletus nanus, Massee.

Distr:—Singapore, *Ridley,* 39 ser. 2.

Boletus nigricans, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 4996.

Boletus pachycephalus, Massee.

Distr:—Singapore, *Ridley,* 24 ser. 2.

Boletus parvulus, Massee.

Distr:—Singapore, *Ridley,* 56 bis. ser. 2.

Boletus pernanus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Botanic Gardens, *E. M. Burkill,* 156; *Baker,* 5001; *Flippance,* 6179.

Boletus phaeocephalus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 5050.

Boletus retisporus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 403, 5000.

Boletus Ridleyi, Massee.

Distr:—Singapore, Gardens' Jungle, on the ground, *Ridley,* 87 ser 2.

Boletus rufo-aureus, Massee.

Distr:—Singapore, *Ridley,* 61 ser 2.

Boletus scaber, Fries.

Distr:—Singapore, *Ridley*, 69.

Boletus singaporensis, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 4992.

Boletus spinifer, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, solitary or tufted, among decaying leaves, *Baker,* 4994.

Boletus tristiculus, Massee.

Distr:—Singapore, *Ridley,* 80 ser 2.

Boletus tristis, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 404, 4995.

Boletus umbilicatus, Massee.

Distr:—Singapore, *Ridley,* 78 ser 2.

Boletus umbrinellus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 405, 4997; *Sappan,* 5488.

Boletus unicolor, Massee.

Distr:—Singapore, *Ridley,* 99 ser 2.

Boletus velutriceps, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 4998.

Boletus viscidulus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 4999.

Boletopsis corrugatus, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Botanic Gardens, *Baker,* 5003; on the ground, *Burkill,* 5786.

Strobilomyces paradox, Massee.

Distr:—Singapore, on the ground, gregarious, *Ridley,* 28 ser 2.

Strobilomyces porphyrius, Pat. and Baker, in Journ. R. As. Soc. Straits Branch, No. 78.

Distr:—Singapore, Gardens' Jungle, *Baker,* 5002.

AGARICACEAE.

Bolbitius longipes, Massee.

Distr:—Selangor, on the ground, *Ridley,* 124.

Coprinus coffeicola, Massee.

Distr:—Selangor, on rotten coffee pulp, *Ridley,* 67.

Coprinus ephemerus, Fries.

Distr:—Singapore, on cow dung, *Ridley,* 32.

Coprinus levipes, Massee.

Distr:—Perak, on an old Areca stump, *Ridley,* 17.

Coprinus niveus, Fries.

Distr:—Singapore, Botanic Gardens, on horse dung, *E. M. Burkill,* 71.

Coprinus plicatilis, Fries.

Distr:—Selangor, *Ridley.* Singapore, Botanic Gardens, on twigs, *E. M. Burkill,* 70.

Gomphidius roseus, Massee.

Distr:—Singapore, on the ground, *Ridley*, 57, E.

Psathyrella albida, Massee.

Distr:—Selangor, in dense clusters on rotten wood, *Ridley*, 55.

Psathyrella disseminata, Pers.

Distr:—Perak, *King's collector.* Dindings, mentioned by *Ridley.* Without precise locality, at the base of trees, *Scortechini,* 42.

Hygrophorus chlorophanus, Fries.

Distr:—Singapore, Botanic Gardens, in the grass, *E. M. Burkill,* 260.

Hygrophorus conicus, Fries.

Distr:—Singapore, *Ridley,* 85.

Hygrophorus puniceus, Fries.
Ridley records this as being very common in grassy spots and among leaves.

Lactarius bicolor, Massee.

Distr:—Singapore, Botanic Gardens, among leaves, *E. M. Burkill*, 73; *Burkill*, Dec. 1916.

Lactarius tricolor, Massee.

Distr:—Singapore, on the ground, *Ridley,* 30 D.

RUSSULA AERUGINOSA, Massee.

Distr::—Singapore, Botanic Gardens, on the ground, *E. M. Burkill* 63; *Flippance*, 6040, 6170, 7006. Economic Garden, *Kiah*, 5745.

RUSSULA FRAGILIS, Fries.

Distr:—Singapore, on the ground, *E. M. Burkill*, 232.

SCHIZOPHYLLUM COMMUNE, Fries. Bancroft, in Agric. Bull. F. M. S. i. 28, 150, 263. Chipp, in Gard. Bull. S. S. ii. 190, 197, 280.

Probably the commonest of the larger fungi, growing everywhere on dead wood.

SCHIZOPHYLLUM FLABELLARE, Fries.

Distr:—Selangor, on rotten wood, *Ridley*, 90.

SCHIZOPHYLLUM MULTIFIDUM, Fries.

Distr:—Without precise locality, on stems, *Scortechini*, 52, 113.

XEROTUS CAFFRORUM, Kalch.

Distr:—Selangor, mentioned by *Ridley*.

XEROTUS LATERITIUS, Berk. and Curt.

Distr:—Perak, *King's collector*, 3983.

XEROTUS PAPYRACEUS, Berk.

Distr:—Penang, on bricks and wood, *Ridley*.

LENTINUS APPLANATUS, Fries. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Perak, *King's collector*.

LENTINUS BECCARIANUS, Ces.

Distr:—Perak, *King's collector*, 3611, 3612.

LENTINUS BLEPHARODES, Berk. and Curt.

Distr:—Perak, *King's collector*, 2988. Selangor, on stumps, *Ridley*.

LENTINUS BREVIPES, Cke.

Distr:—Perak, on logs, *King's collector*, 4, 342.

LENTINUS CALVESCENS, Berk.

Distr:—Selangor, *Ridley*, 102.

LENTINUS CURREYANUS, Sacc.

Distr:—Selangor, Gua Batu, *Ridley*, 90.

LENTINUS DACTYLIOPHORUS, Lev. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Perak, *Kunstler*, 611.
See remarks under L. exilis.

LENTINUS EXILIS, Kl. Bancroft, in Agric. Bull. F. M. S. i. 263.

Very common on dead wood everywhere. Extremely variable as to form, size, and texture. It would appear that L. Sajor-caju, and L. dactyliophorus, are identical.

LENTINUS INQUINANS, Berk.

Distr:—Perak, *King's collector.*

LENTINUS LECOMTEI, Fries.

Distr:—Selangor, Kuala Lumpor, on a Casuarina equisetifolia stump, *Chipp*, 5679. Singapore, on dead wood, Botanic Gardens, *Flippance*, 4921, 5944, 6172. Economic Garden, *Kiah*, 5848.

Some authorities regard these specimens as belonging to L. strigosus.

LENTINUS LEUCOCHROUS, Lev. Baker, in Gard. Bull. S. S. ii. 112.

Distr:—Singapore, on dead limbs of Hevea brasiliensis, *Baker.*

LENTINUS NICOBARENSIS, Rch.

Distr:—Without precise locality, on decaying wood, *Scortechini.*

LENTINUS PERGAMENUS, Lev.

Distr:—Perak, *King's collector*, 2183, 2184 .

LENTINUS SAJOR-CAJU, Fries.

Considered in this work as being the same as L. exilis, Kl. It is a matter for consideration as to which name should be kept up.

LENTINUS SERICEUS, Massee.

Distr:—Selangor, on rotten wood, *Ridley*, 33.

LENTINUS SIMILIS, Berk.

Distr:—Singapore, *Ridley*, 9.

LENTINUS STRIGOSUS, Fries.

The specimens quoted under L. Lecomtei are considered by some to belong to this species.

LENTINUS SUBNUDUS, Berk.

Distr:—Perak, *King's collector*, 3976. Singapore, Mandai Road, on dead wood, *Chipp*, 5825. Bukit Timah, *Chipp*, 5076, 5089. Reformatory Road in copious white tufts on a dying stem of a Durio zibethinus, *Chipp*, 6185.

LENTINUS TENER, Kl.

Distr:—Perak, *King's collector*, 3202, 4388.

LENTINUS TENUIPES, Sacc. and Paol.

Distr:—Perak, *King's collector*. Without precise locality, on dead wood, *Scortechini*, 10.

LENTINUS VELUTINUS, Fr.

Distr:—Perak, *King's collector*, 2295.

LENTINUS VILLOSUS, Fries.

Distr:—Selangor, *Ridley*, 77.

PANUS AUREO-FULVUS, Cke.

Distr:—Perak, on logs, *King's collector*, 1893.

PANUS FENDLERI, Berk.

Distr:—Perak, mentioned by *Ridley*.

MARASMIUS ANDROSACEUS, Fries.

Distr:—Perak, mentioned by *Ridley*. Without precise locality, on decaying leaves, *Scortechini*, 3.

MARASMIUS ARATUS, Massee.

Distr:—Singapore, Botanic Gardens, on dead leaves, *E. M. Burkill*, 113.

MARASMIUS EPOCHNOUS, Berk. and Curt.

Distr:—Selangor, on dead bark and wood, *Ridley*, 78.

Marasmius excentricus, Massee.

Distr:—Perak, gregarious, on dead wood, *Ridley,* 18.

Marasmius gordipes, Sacc. and Paol.

Distr:—Perak, mentioned by *Ridley.* Without precise locality, on dead leaves, *Scortechini,* 11.

Marasmius lanatus, Massee.

Distr:—Singapore, Botanic Gardens, on a dead leaf of Oncosperma, *E. M. Burkill,* 86.

Marasmius papyraceus, Massee.

Distr:—Singapore, Botanic Gardens, on a dead stick, *E. M. Burkill,* 121.

Marasmius polygrammus, Mont.

Distr:—Without precise locality, on decaying leaves, *Scortechini,* 12.

Marasmius rotalis, Berk. and Br. Bancroft, in Agric. Bull. F. M. S. i. 263. Chipp, in Gard. Bull. S. S. ii. 187.

Distr:—Without precise locality, on thick decaying leaves, *Scortechini,* 13.

Marasmius rotula, Fries.

Distr:—Selangor, on dead branches, *Ridlēy,* 74.

Marasmius stenophyllus, Mont.

Distr:—Without precise locality, on branches, *Scortechini,* 541.

Psathyra campanulata, Massee.

Distr:—Selangor, on the ground, *Ridley,* 108.

Psathyra cyclospora, Massee.

Distr:—Perak, on rotten wood, *Ridley,* 7.

Hypholoma elatum, Massee.

Distr:—Singapore, on the ground, *Ridley,* 83E.

Hypholoma sublateritium, Schaeff.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill,* 127.

Agaricus (Psalliota) campestris, Linn. Ridley, in Agric. Bull. Mal. Penin. 1898, p. 198. Bancroft, in Agric. Bull. F. M. S. i. 263.

The common English "mushroom." Mentioned by Ridley as occurring in Penang, Pahang, and Singapore. Frequently found on tennis lawns. Apparently not eaten by the Malays.

Agaricus (Psalliota) tenuiceps, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill*, 267. Tyersall Grounds, *Burkill*, 6159.

Stropharia minima, Massee.

Distr:—Singapore, Botanic Gardens, on horse dung, *E. M. Burkill*, 266.

Stropharia personata, Massee.

Distr:—Singapore, on the ground, *Ridley*, 55C.

Stropharia umbonata, Massee.

Distr:—Singapore, on the ground, *Ridley*, 36J. Botanic Gardens, on the ground, *Flippance*, 5946, 6178.

Crepidotus Ridleyi, Massee.

Distr:—Selangor, on a dead fern rachis, *Ridley*, 110.

Galera flexipes, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill*, 111.

Inocybe longipes, Massee.

Distr:—Singapore, on the ground, *Ridley*, 73U.

Inocybe umbrina, Massee.

Distr:—Singapore, Havelock Road, on a clay bank, *E. M. Burkill*, 250.

Inocybe violacea, Massee.

Distr:—Perak, on lawns, *Ridley*, 2.

Naucoria periniana, Sacc.

Distr:—Perak, *King's collector*.

Naucoria trichialis, Lev.

Distr:—Perak, *King's collector*.

Flammula bella, Massee.

Distr:—Singapore, Botanic Gardens, on a jungle path, *E. M. Burkill*, 134.

Flammula elegantula, Massee.

Distr:—Singapore, Payar Lebar, on a dead stem of Cocos nucifera, *E. M. Burkill*, 324.

Flammula ornata, Massee.

Distr:—Selangor, on the ground, *Ridley*, 23.

Pholiota hepatica, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill*. 204.

Claudopus griseus, Massee.

Distr:—Perak, on dead wood, *Ridley*, 11.

Eccilia hyalodepas, Berk. and Br.

Distr:—Singapore, *Ridley*, 23.

Leptonia altisssima, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *Ridley*, 4.

Leptonia bicolor, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *Ridley*.

Leptonia tricolor, Massee.

Distr:—Penang, on the ground, *Ridley*.

Entoloma Burkillae, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill*, 152; *Burkill*, April 1916.

Entoloma iodnephes, Berk. and Br.

Distr:—Singapore, *Ridley*, 19.

Entoloma umbonatum, Massee.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill*, 61.

Clitopilus curtipes, Massee.

Distr:—Singapore, on the ground, *Ridley*, 91.

CLITOPILUS FLAVIDUS, Massee.

Distr:—Singapore, on the ground, *Ridley*, 560.

VOLVARIA GEASTER, Berk. and Br.

Distr:—Singapore, *Ridley*, 23.

PLEUROTUS spp.

Several specimens of this genus have been collected but not worked out specifically, amongst them being the common luminous fungus.

OMPHALIA TENERA, Massee.

Distr:—Perak, on rotten wood, *Ridley*, 9.

MYCENA CRASSIPES, Massee.

Distr:—Selangor, on stumps, *Ridley*, 64.

MYCENA CUSPIDATA, Massee.

Distr:—Singapore, on the ground, *Ridley*, 25y.

MYCENA GIGANTOSPORA, Massee.

Distr:—Perak, on the ground, *Ridley*, 3. Dindings, mentioned by *Ridley*.

MYCENA PELLICULOSA, Fries.

Distr:—Perak, on rotten wood, *Ridley*, 13. Dindings, mentioned by *Ridley*.

MYCENA REPERTITIA, Massee.

Distr:—Perak, on rotting wood, *Ridley*, 21.

COLLYBIA ACUMINATA, Massee.

Distr:—Singapore, on the ground, *Ridley*, 22v.

COLLYBIA ALTISSIMA, Massee.

Distr:—Singapore, on the ground. *E. M. Burkill*, 112.

COLLYBIA ELATA, Massee.

Distr:—Singapore, on the ground, *E. M. Burkill*, 150; *Chipp*, 5841.

COLLYBIA RAPHANIPES, Berk.

Distr:—Perak, *King's collector*, 6006.

CLITOCYBE CARNOSA, Massee.

Distr:—Singapore, on the ground, *E. M. Burkill,* 82.

CLITOCYBE EGREGIA, Massee.

Distr:—Singapore, on the ground, *Ridley,* 89.

CLITOCYBE LACCATA, Scop.

Distr:—Perak, *King's collector,* 1590. Singapore, *Ridley,* 1, 37, 78.

TRICHOLOMA CHARISTERUM, Berk. and Br.

Distr:—Singapore, *Ridley,* 64.

TRICHOLOMA NUDUM, Bull.

Distr:—Singapore. *Ridley,* 86.

TRICHOLOMA THEIOCHROUM, Berk. and Br.

Distr:—Singapore. *Ridley,* 68.

SCHULZERIA PELLUCIDA, Massee.

Distr:—Singapore, Botanic Gardens. amongst fallen leaves, *E. M. Burkill,* 101.

ARMILLARIA SQUAMOSA, Massee.

Distr:—Singapore, on the ground, *Ridley,* 61. 1.

LEPIOTA ALBIDA, Massee.

Distr:—Singapore, Botanic Gardens, among the nests of black termites, *E. M. Burkill,* 219.

LEPIOTA CARNEO-RUBRA, Massee.

Distr:—Singapore. Botanic Gardens, on the ground, *E. M. Burkill,* 136.

LEPIOTA CITRIOPHYLLA, Berk. and Br.

Distr:—Singapore, *Ridley,* 66.

LEPIOTA CONIOCEPHALA, Berk. and Br.

Distr:—Singapore, *Ridley,* 44.

LEPIOTA EUCONIATA, Berk. and Br.

Distr:—Singapore, *Ridley,* 41.

LEPIOTA FELINA, Pers.

Distr:—Singapore, *Ridley*, 33.

LEPIOTA FERRUGINOSA, Massee.

Distr:—Singapore, on the ground, *E. M. Burkill*, 214.

LEPIOTA HOLOSPILOTA, Berk. and Br.

Distr:—Singapore, *Ridley*, 20.

LEPIOTA INEBRIATA, Berk. and Br.

Distr:—Singapore, *Ridley*, 47.

LEPIOTA LICMOPHORA, Berk. and Br.

Distr:—Singapore, *Ridley*, 79.

LEPIOTA OCHRACEA, Massee.

Distr:—Singapore, on the ground, *E. M. Burkill*.

LEPIOTA PHYLACTARODES, Berk. and Br.

Distr:—Singapore, *Ridley*, 61.

LEPIOTA PROCERA, Scop. Bancroft, in Agric. Bull. F. M. S. i. 262.

Distr:—Selangor, on the ground, *Bancroft*.

LEPIOTA SEMIVESTITA, Massee.

Distr:—Singapore, on the ground, *E. M. Burkill*. 142, 143.

AMANITA VIRGINEA, Massee.

Distr:—Singapore, on the ground, *Ridley*, 1, 87. Botanic Gardens, on the ground, *E. M. Burkill*, 182; *Flippance*, 6059.

PHALLACEAE.

MUTINUS BAMBUSINUS, Zoll.

Distr:—Singapore, Botanic Gardens, among bamboos, *Ridley*.

PHALLUS DEMONUM, Rumph.

Distr:—Perak, *King's collector*, 3550, 4037.

DICTYOPHORA INDUSIATA, Fisch.

Distr:—Singapore, Payar Lebar, *E. M. Burkill*, 181. Cluny Road, *E. M. Burkill*, 337.

Occurring generally as isolated specimens on the ground under trees.

DICTYOPHORA IRPICINA.

Distr:—Singapore, Botanic Gardens, *Ridley.*

DICTYOPHORA PHALLOIDEA, Desv. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Singapore, Botanic Gardens, *Ridley.*

LYCOPERDACEAE.

LYCOPERDON LIGNICOLUM, Massee.

Distr:—Selangor, Kuala Lumpor, on dead bark, *Ridley,* 166.

LYCOPERDON RUBICULA, Berk. and Br.

Distr:—Singapore, *Ridley,* 52.

LYCOPERDON WRIGHTII, Berk.

Distr:—Singapore, Botanic Gardens, on the ground, *Sappan,* 5489.

CATASTOMA JUNGHUHNII, Schl. Ridley, in Journ. R. As. Soc. Straits Branch, No. 23, p. 75.

Distr:—Dindings, *Ridley.* Selangor, Bukit Etam, *Kelsall.* Petaling, *Ridley.* Singapore, Bukit Timah, *Ridley.*

CATASTOMA ORIRUBRUM, Cke.

Distr:—Perak, Larut, *King's collector.*

GEASTER JAVANICUS, Lev.

Distr:—Singapore, Botanic Gardens, on the ground, *Sappan,* 5127.

GEASTER MAURUS, Massee.

Distr:—Singapore, Botanic Gardens, 1891, *Ridley*; under cocoa trees, *E. M. Burkill,* 230; *Ridley,* 30.

GEASTER MIRABILIS, Mont.

Distr:—Singapore, Woodlands, on dead wood, *M. Noor,* 5378 Economic Gardens, on rotten wood, *E. M. Burkill,* 248.

GEASTER PAPYRACEUS, Berk. and Curt.

Distr:—Singapore, on wood, *Ridley,* 23, W.

NIDULARIACEAE.

CYATHUS SPHAEROSPORUS.

Distr:—Singapore, Botanic Gardens, on dead wood, *Sappan,* 5113; *Flippance,* 6184. Economic Gardens, *Kiah,* 5715.

Lloyd suggests this species may only be a large globose-spored form of C. pallidus.

CYATHUS STRIATUS, Hoffm. Sharples, in Agric. Bull. F. M. S. ii. 85.

Distr:—Without precise locality, on dead wood, *Sharples.*

SCLERODERMATACEAE.

SCLERODERMA AUREUM, Massee.

Distr:—Singapore, Botanic Gardens, *Ridley,* 32 vc.

SCLERODERMA FLAVIDUM, Ell.

Distr:—Penang, Government Hill Road, *Burkill,* 6074; Singapore, Botanic Gardens, on jungle soil, *Baker,* 5134; *Chipp,* 6017.

SCLERODERMA FLAVO-CROCATUM, Sacc. and De-Ton. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Perak, *King's collector.* Singapore, Botanic Gardens, jungle, *Ridley.* Without precise locality, on the ground, *Scortechini,* 174.

SCLERODERMA LUTEUM, Lloyd.

Distr:—Singapore, Botanic Gardens, on the ground, *E. M. Burkill,* 268, 294; *Kiah,* 5903.

SCLERODERMA SINNAMARIENSE, Mont.

Distr:—Perak, *King's collector.* Without precise locality, on wood, *Scortechini,* 781.

SCLERODERMA VULGARE, Fries.

Distr:—Perak, *King's collector,* 4000.

CALOSTOMATACEAE.

MITREMYCES COCCINEUS, Berk.

Distr:—Perak, *King's collector,* 3838.

TULOSTOMATACEAE.

TULOSTOMA RIDLEYI, Massee.

Distr:—Perak, on the ground, *Ridley,* 8.

FUNGI IMPERFECTI.

SPHAERIOIDACEAE.

PHYLLOSTICTA COFFEICOLA, Del. Belgrave, in Agric. Bull. F. M. S. iv. 111. Chipp, in Gard. Bull. S. S. ii. 237.

Recorded as parasitic on coffee leaves.

PHYLLOSTICTA DAEMONOROPIS, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on leaves of Daemonorops, *Baker,* 474.

PHLLOSTICTA DUBIA, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on dead calyces of Dianthus sinensis, *Baker*, 475.

PHYLLOSTICTA FARADAYAE, Sacc. Baker, in Gard. Bull. S. S. ii. 119.

Distr:—Singapore, Botanic Gardens, on dying leaves of Faradaya papuana, *Baker*, 476.

PHYLLOSTICTA GUSTAVIAE, Sacc. Baker, in Gard. Bull. S. S. ii. 119.

Distr:—Singapore, Botanic Gardens, on dying leaves of Gustavia insignis, *Baker*, 5112.

PHYLLOSTICTA HEVEAE, Limm. Bancroft, in Agric. Bull. F. M. S. i. 263; and in Dep. Agric. F. M. S. Bull. No. 14, p. 22. Chipp, in Gard. Bull. S. S. ii. 189, 190.

Recorded as parasitic on leaves of Hevea brasiliensis.

PHYLLOSTICTA PALMIGENA, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on dying leaves of Dictyosperma album, *Baker*, 477.

PHYLLOSTICTA RAMICOLA, Petch. Bancroft, in Agric. Bull. F. M. S. i, 25, 29, 263. Chipp, in Gard. Bull. S. S. ii. 189.

Recorded by Bancroft as a stem disease of Hevea brasiliensis.

PHOMA AGAVES, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 232.

Distr:—Singapore, Botanic Gardens, on dead peduncles of Agave rigida, *Baker*, 473.

PHOMA CAMELLIAE, Cke. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Perak, *King's collector.* Johore, on leaves of Camillea theae, recorded by Cooke.

PHOMA INOCARPI, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Botanic Gardens, on decaying fruits of Inocarpus edulis, *Baker,* 414c.

SPHAERONEMA sp. Belgrave, in Agric. Bull. F. M. S. vi. 7. Chipp, in Gard. Bull. S. S. ii. 190.

Distr:—Johore, Pagoh, Muah, on Hevea brasiliensis, causing "Mouldy Rot," *South,* 6071.

HAPLOSPORELLA SYCONOPHILA, Sacc. Baker, in Gard. Bull. S. S. ii. 119.

Distr:—Singapore, Botanic Gardens, on dead bark of Ficus elastica, *Baker,* 431.

DOTHIORELLA RUGULOSA, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Botanic Gardens, on dead and dying stems of Hibiscus Sabdariffa, *Baker,* 415.

DOTHIORELLA STRATOSA, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, Botanic Gardens, on dead limbs of Piscidia erythrina, *Baker,* 416a.

CONIOTHYRIUM COFFEAE. Belgrave, in Agric. Bull. F. M. S. iv. 111. Chipp, in Gard. Bull. S. S. ii. 236.

Described as parasitic on leaves of coffee.

DARLUCA FILUM, Br.

Distr:—Singapore, Botanic Gardens, on Andropogon Nardus v. citronella, *Baker,* 482b.

DIPLODIA HIBISCINA, C. and Ell.

VAR. SABDARIFFAE, Sacc. Baker. in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Botanic Gardens, on dead stems of Hibiscus sabdariffa, *Baker,* 413.

DIPLODIA INOCARPI, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Botanic Gardens, on rotting fruits of Inocarpus edulis, *Baker,* 414a.

DIPLODIA MARUMIAE, Sacc. and Paol.

Distr:—Without precise locality, on leaves of Marumia, *Scortechini*, 130.

DIPLODIA RAPAX, Massee. Ridley, in Agric. Bull. S. and F. M. S. viii, 290 and 571. Chipp, in Gard. Bull. S. S. ii. 188.

Recorded by Ridley on shoots of Hevea brasiliensis.

DIPLODIA spp. Bancroft, in Agric. Bull. S. and F. M. S. x. 321; and in Agric. Bull. F. M. S. i. 28, 111. Chipp, in Gard. Bull. S. S. ii. 188, 235, 236.

CHAETODIPLODIA sp. Belgrave, in Agric. Bull. F. M. S. iv. 111.

Described as parasitic on the stems of coffee.

BOTRYODIPLODIA CEREBRINA, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 234.

Distr:—Singapore, Botanic Gardens, on dead branches of Cecropia peltata, *Baker*, 406.

BOTRYODIPLODIA THEOBROMAE. Richards, in Agric. Bull. F. M. S. v. 308. Chipp, in Gard. Bull. S. S. ii. 188.

Recorded as a cause of "dieback" of Hevea brasiliensis.

BOTRYODIPLODIA sp. Ridley, in Agric. Bull. S. and F. M. S. ix. 178. Chipp, in Gard. Bull. S. S. ii. 235.

A cause of root disease.

HENDERSONIA sp. Belgrave, in Agric. Bull. F. M. S. iii. 229. On Garcinia Mangostana.

SEPTORIA CYRTOPHYLLI, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on leaves of Cyrtophyllum fragrans, *Baker*, 485.

SEPTORIELLA BIFORMIS, Sacc. Baker, in Gard. Bull. S. S. ii. 119.

Distr:—Singapore, Botanic Gardens, on living leaves of Ficus alba, *Baker*, 486.

SEPTORIELLA CONFORMIS, Sacc. Baker, in Gard. Bull. S. S. ii. 119.

Distr:—Singapore, Botanic Gardens, on living leaves of Ficus sp., *Baker*, 487.

PHOMOPSIS sp.

Distr:—Penang, Government Hill, on leaves of Macaranga, *Chipp*, 4695.

NECTRIOIDACEAE.

ASCHERSONIA sp.

Distr:—Penang, Waterfall Gardens, on coccids on leaves of Eugenia, *Burkill*, 4133. Singapore, Economic Garden, on leaves of Myrica, *Flippance*, 4933.

LEPTOSTROMATACEAE.

LEPTOTHYRELLA CALOPHYLLI, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 233.

Distr:—Singapore, Botanic Gardens, on living leaves of Calophyllum floribundum, *Baker*, 445.

MELANCONIACEAE.

GLOEOSPORIUM ALBORUBRUM, Petch. Bancroft, in Agric. Bull. F. M. S. i. 263. Chipp, in Gard. Bull. S. S. ii. 189.

Recorded on dead shoots of Hevea brasiliensis.

GLOEOSPORIUM INOCARPI, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 276.

Distr:—Singapore, Botanic Gardens, on rotting fruits of Inocarpus edulis, *Baker*, 414b.

GLOEOSPORIUM MANGIFERAE, Noack. Bancroft, in Agric. Bull. F. M. S. i. 113, 263. Chipp, in Gard. Bull. S. S. ii. 278.

Parasitic on fruits of Mangifera indica.

GLOEOSPORIUM MUSARUM, Cke. and Massee. Bancroft, in Agric. Bull. F. M. S. i. 263. Chipp, in Gard. Bull. S. S. ii. 278.

Common on ripe fruits of Banana.

GLOEOSPORIUM PALMIGENUM, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 232.

Distr:—Singapore, Botanic Gardens, on dead leaves of Attalea Cohune, *Baker*, 427.

GLOESPORIUM ZIBETHINUM, Sacc. Baker, in Gard. Bull. S. S. ii. 119. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on leaves of Durio zibethinus, *Baker*, 428.

COLLETOTRICHUM NECATOR, Massee. Ridley, in Agric. Bull. S. and F. M. S. x. 321. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, on fruits of pepper, *Ridley*.

COLLETOTRICHUM THEAE, Massee. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Negri Sembilan, parasitic on leaves of Thea, *Bancroft*.

COLLETOTRICHUM sp. Van Hall, in Agric. Bull. F. M. S. i. 255. Belgrave, in Agric. Bull. F. M. S. iv. 111. Chipp, in Gard. Bull. S. S. ii. 236.

Recorded as a disease of coffee.

MELANCONIUM MELANOXANTHUM, Berk. and Br. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 233, 277, 279, 281.

Distr:—Singapore, Botanic Gardens, on dead leaves and rachises, *Baker,* 448, 5382, 5414, 5426, 5440, 5442.

MELANCONIUM STICTOIDES, Sacc. and Paol.

Distr:—Without precise locality, on leaves, *Scortechini,* 148.

SEPTOGLOEUM ARACHIDIS, Rac. Brooks, in Agric. Bull. F. M. S. iii. 66.

Recorded as attacking leaves of Arachis hypogaea.

STILBOSPORA sp.

Distr:—Penang, Waterfall Gardens, on leaves of Licuala, *Burkill,* 4150.

CORYNEUM sp. Burkill, in Gard. Bull. S. S. i. 193. Chipp, in Gard. Bull. S. S. ii. 237.

Recorded as attacking leaves of Agave.

PESTALOZZIA COFFEAE, Belgrave, in Agric. Bull. F. M. S. iv. 113. Chipp, in Gard. Bull. S. S. ii. 237.

Recorded on coffee berries.

PESTALOZZIA FUNEREA, Desm.

Distr:—Singapore, Economic Garden, on leaves of Eugenia brasiliensis, *Mathieu,* 4923.

PESTALOZZIA GUEPINI, Desm. Bancroft, in Agric. Bull. F. M. S. i. 263; and in Dep. Agric. F. M. S. Bull. No. 14. Chipp, in Gard. Bull. S. S. ii. 190.

Recorded as a leaf disease of Hevea brasiliensis.

PESTALOZZIA LEUCODISCA, Penz. and Sacc. Bancroft, in Agric. Bull. F. M. S. i. 263.

Distr:—Selangor, on leaves of a jungle plant, *Bancroft.*

PESTALOZZIA PALMARUM, Cke. Bancroft, in Agric. Bull. F. M. S. i. 263; and in Dep. Agric. F. M. S. Bull. No. 14. Sharples, in Agric. Bull. F. M. S. iii. 381. Chipp, in Gard. Bull. S. S. ii. 235.

Recorded as a leaf disease of Cocos nucifera and Cinnamomum zeylanicum.

MUCEDINACEAE.

CHROMOSPORIUM CRUSTACEUM, Sharp. in Dep. Agric. F. M. S. Bull. No. 19, 12. Chipp, in Gard. Bull. S. S. ii. 191.

Recorded as causing a black spotting on prepared rubber.

OOSPORA GILVA, Berk. Bancroft, in Agric. Bull. F. M. S. i. 264. Chipp, in Gard. Bull. S. S. ii. 189.

Common on burnt wood.

MONILIA AURANTIACA, Pen. and Sacc.

Distr:—Singapore, Botanic Gardens, on a burnt log, *Chipp*, 4818.

CEPHALOSPORIUM sp. Belgrave, in Agric. Bull. F. M. S. iv. 111. vi. 7. Chipp, in Gard. Bull. S. S. ii. 188, and 236.

Recorded as parasitic on Hemileia Vastatrix, and as a cause of "mouldy rot" on Hevea brasiliensis.

TRICHODERMA KONINGII, Oud. Sharples, in Dep. Agric. F. M. S. Bull. No. 19, 12. Chipp, in Gard. Bull. S. S. ii. 191.

Distr:—Singapore, Botanic Gardens, on a burnt log, *Chipp*, 4819.

HYALOPUS sp. Belgrave, in Agric. Bull. F. M. S. iv. 111. Chipp, in Gard. Bull. S. S. ii. 236.

Recorded as parasitic on Hemileia Vastatrix.

STERIGMATOCYSTIS VITELLINA, Massee.

Distr:—Singapore, Bukit Timah, on fallen jungle fruits, *Ridley*.

STERIGMATOCYSTIS sp. Bancroft, in Dep. Agric. F. M. S. Bull. No. 16.

Recorded as occurring on rubber sheet.

PENICILLIUM GLAUCUM, Link. Bancroft, in Agric. Bull. F. M. S. i. 264.

A common "mildew."

PENICILLIUM MACULANS. Sharples, in Dep. Agric. F. M. S. Bull. No. 19, 8. Chipp, in Gard. Bull. S. S. ii. 191.

Recorded as causing a yellow flush on prepared rubber.

BOTRYTIS NECANS, Massee. Burkill, in Gard. Bull. S. S. i. 208.

Distr:—Singapore, Botanic Gardens, on larvae of Brachartona catoxantha, *Burkill.*

PHYSOSPORA sp.

Distr:—Penang, Residency Gardens, on living leaves of Kopsia fruticosa, *Burkill*, 6201.

SEPEDONIUM DUBIUM, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 277.

Distr:—Singapore, Botanic Gardens, on leaves of Licuala, *Baker,* 484.

MYCOGYNE sp. Bancroft, in Dep. Agric. F. M. S. Bull. No. 16.

DEMATIACEAE.

CONIOSPORIUM VACUOLATUM, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 233, and 277.

Distr:—Singapore, Botanic Gardens, on dead stems of Calamus and dead leaves of Licuala, *Baker,* 5444, 432b.

THIELAVIOPSIS ETHACETICA. Chipp, in Gard. Bull. S. S. ii. 236.

Recorded by Richards on Cocos nucifera stem.

THIELAVIOPSIS sp. Bancroft, in Agric. Bull. F. M. S. i. 111. Chipp, in Gard. Bull. S. S. ii. 236.

Recorded in connection with coconut bud rot.

MYXOTRICHUM COPROGENUM, Sacc.

Distr:—Without precise locality, *Scortechini,* 191.

TRICHOSPORIUM SELENIOIDES, Sacc. and Paol.

Distr:—Without precise locality, on stems, *Scortechini.*

HADROTRICHUM ATROMACULANS, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 233.

Distr:—Singapore, Botanic Gardens, on dead stems of Calamus, *Baker,* 430a.

CLADOSPORIUM ELEGANS, Penz.

VAR. SINGAPORENSE, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 234.

Distr:—Singapore, Botanic Gardens, on dying leaves of Citrus acida, *Baker.*

CLADOSPORIUM OCCULTUM, Ces.

Distr:—Penang, May 1865, *Beccari.*

HELMINTHOSPORIUM HEVEAE, Petch. Ridley, in Agric. Bull. S. and F. M. S. v. 68. Chipp, in Gard. Bull. S. S. ii. 190.

Recorded on leaves of Hevea brasiliensis.

HELMINTHOSPORIUM MACRURUM, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 277.

Distr:—Singapore, Botanic Gardens, on rotting rachises of Licuala, *Baker,* 432a.

HELMINTHOSPORIUM OBOVATUM, Massee. Bancroft, in Agric. Bull. F. M. S. i. 264. Chipp, in Gard. Bull. S. S. ii. 280.

Distr:—Selangor, Kuala Lumpor, on living leaves of Pterocarpus indicus, *Bancroft.*

HELMINTHOSPORIUM RAVENALII, Berk. and Curt.

Distr:—Selangor, Port Swettenham, *Burkill,* 4105.

HELMINTHOSPORIUM SPIROTRICHUM, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on leaves of Cyrtophyllum fragrans, *Baker,* 432.

HELMINTHOSPORIUM SUBSIMILE, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 233.

Distr:—Singapore, Ponggul, on leaves of Bruguiera eriopetala, *Baker,* 434a.

SPONDYLOCLADIUM MACULANS, Banc. Bancroft, in Agric. Bull. F. M. S. i. 264; and in Dep. Agric. F. M. S. Bull. No. 16. Chipp, in Gard. Bull. S. S. ii. 191.

Recorded on prepared rubber.

CERCOSPORA BETICOLA, Sacc. Bancroft, in Agric. Bull. F. M. S. i. 113, and 264.

Distr:—Perak, Taiping, Maxwell Hill, parasitic on beet and spinach, *Bancroft.*

Cercospora Cearae, Petch. Bancroft, in Agric. Bull. F. M. S. i. 264. Chipp, in Gard. Bull. S. S. ii. 278.

Described as parasitic on leaves of Manihot and Tapioca.

Cercospora Coffeae. van Hall, in Agric. Bull. F. M. S. i. 255.

Recorded as a disease of Coffea robusta.

Cercospora personata, Ellis. Bancroft, in Agric. Bull. F. M. S. i. 113, 264. Chipp, in Gard. Bull. S. S. ii. 232.

Distr:—Selangor, parasitic on leaves of Arachis hypogaea, *Bancroft.*

Cercospora Tabernaemontanae, Syd. Chipp, in Gard. Bull. S. S. ii. 281.

Distr:—Perak, Taiping Gardens, on living leaves of Tabernaemontana, *Chipp,* 4956. Doubtfully referred to this species by Butler.

Cercospora Ubi, Rac.

Distr:—Penang, Government Hill, on living leaves of Dioscorea glabra, *Chipp,* 4686.

Cercospora virens, Sacc. Baker, in Gard. Bull. ii. 120. Chipp, in Gard. Bull. S. S. ii. 277.

Distr:—Singapore, Botanic Gardens, on Licuala sp., *Baker,* 407.

STILBACEAE.

Stilbella Heveae, Lim. Bancroft, in Agric. Bull. F. M. S. i. 28, 264. Chipp, in Gard. Bull. S. S. ii. 190.

Recorded on the dead bark of Hevea brasiliensis.

Stilbum cinnabarinum. Brooks, in Agric. Bull. F. M. S. iii. 41. Chipp, in Gard. Bull. S. S. ii. 190.

Considered by Brooks to be the conidial stage of Megalonectria pseudotrichia.

Stilbum incarnatum, Walk.

var. Dioscoreae, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 237.

Distr:—Singapore, Botanic Gardens, on rotting roots of Dioscorea sp., *Baker,* 5417.

Corallodendron aurantiacum, Massee.

Distr:—Singapore, Bukit Timah, forming bright orange yellow tufts on seeds of Willughbeia, *Ridley.*

Isaria Sphingum, Schw.

Distr:—Singapore, parasitic on the Hawk moth, especially Sphinx convolvuli, *Ridley.*

Podosporium aciculare, Sacc. and Paol.

Distr:—Without precise locality, on dead stems, *Scortechini,* 58.

Podosporium Consors, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 233.

Distr:—Singapore, Ponggul, on living leaves of Bruguiera eriopetala, *Baker,* 434b.

Podosporium Penicillium, Speg. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 280.

Distr:—Singapore, Botanic Gardens, on leaves of Rhodomyrtus tomentosa, *Baker,* 478.

var. Clerodendri, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 235.

Distr:—Singapore, Botanic Gardens, on leaves of Clerodendron serratum, *Baker,* 479.

Arthrobotryum socium, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, Botanic Gardens, on dead rachises of Plectocomia, *Baker,* 429b.

TUBERCULARIACEAE.

Hymenula socia, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, Botanic Gardens, on dead limbs of Piscidia erythrina, *Baker,* 416b, 5126 bis.

Tubercularia apiospora, Dur. and Mont.

Distr:—Singapore, Botanic Gardens, on dead wood, *Ridley.*

Necator decretus, Massee. Ridley, in Agric. Bull. S. and F. M. S. 1897, 147. Chipp, in Gard. Bull. S. S. ii. 236.

Distr:—Selangor, attacking coffee stems, *Ridley.*

Fusarium spp. Belgrave, in Agric. Bull. F. M. S. iv. 113. Sharples, in Agric. Bull. F. M. S. iv. 218; and in Dep. Agric. F. M. S. Bull. No. 19. Chipp, in Gard. Bull. S. S. ii. 191, 236, 276.

Recorded on dead coffee berries, as causing "die back" on Hibiscus Rosa-sinensis, and a violet flush on prepared rubber.

Chaetostroma cladosporioides, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, Botanic Gardens, on dead caryopses of Paspalum, *Baker*, 4932.

Exosporium eximium, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 232.

Distr:—Singapore, Botanic Gardens, on dead leaves of Areca Catechu, *Baker*, 418.

Exosporium macrurum, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 279.

Distr:—Singapore, Botanic Gardens, on dead leaves of Plectocomia, *Baker*, 419.

Tetrachia singularis, Sacc. Baker, in Gard. Bull. S. S. ii. 120. Chipp, in Gard. Bull. S. S. ii. 234.

Distr:—Singapore, Botanic Gardens, on living leaves of Clerodendron penduliflorum and Ficus alba, *Baker*, 490, 491.

BIBLIOGRAPHY.

BAKER, C. F. Hevea versus Fungi: in *Gard. Bull. S. S.* Vol. II. p. 109. Fungi from Singapore and also from Penang: in *Gard. Bull. S. S.* Vol. II. p. 116.

BANCROFT, K. As cited in the text in:—*Agric. Bull. S. and F. M. S.; Agric. Bull. F. M. S.; Dep. Agric. F. M. S. Bull.*

BELGRAVE, W. N. C. As cited in the text in:—*Agric. Bull. F. M. S.; Dep. Agric. F. M. S. Bull.*

BROOKS, F. T. As cited in the text in:—*Agric. Bull. F. M. S.*

BROOKS, F. T. and A. SHARPLES. As cited in the text in:—*Dep. Agric. F. M. S. Bull.*; Fungoid Diseases of Rubber Trees in Malaya: *Introductory Paper, Internationaal Rubbercongres, Batavia,* Sept. 1914.

BURKILL, I. H. A Disease of Agaves: in *Gard. Bull. S. S.* Vol. I. p. 193.

CESATI, V. Mycetum in itinere borneensi lectorum a cl. Od. Beccari: in extract from *Atti della Reale Accademia della Scienze e Matematiche di Napoli,* Vol. VIII. 1878.

CHIPP, T. F. The Fungus Flora of Hevea brasiliensis: in *Gard. Bull. S. S.* Vol. II. p. 186.

The Angsana Tree: in *Gard. Bull. S. S.* Vol. II. p. 197.

Echinodia Theobromae, Pat.: in *Gard. Bull. S. S.* Vol. II. p. 199.

A Host Index of Fungi of the Malay Peninsula: in *Gard. Bull. S. S.* Vol. II. p. 231, and p. 276.

COOKE, M. C. Enumeration of Polyporus: in *Journ. Linn. Soc.* 1878, p. 131. Under various headings in *Grevillea* at the following references:— VII. p. 14. XI. p. 85. XII. p. 70. XIII. pp. 1 and 32. XIV. pp. 12 and 43. XV. p. 21. XVIII. p. 34. XIX. p. 93. XX. pp. 33 and 92.

Fox, W. — Notes on the Angsana Tree Disease in Penang: in *Agric. Bull. S. and F. M. S.* Vol. IX. p. 133.

Fungi from Penang, from Mr. Fox: in *Agric. Bull. S. and F. M. S.* Vol. IX. p. 135.

Gallagher, W. J. — Root Disease of Hevea brasiliensis, the Para Rubber Tree: in *Dep. Agric. F. M. S. Bull.* No. 2.

A preliminary Note on a branch and stem Disease of Hevea brasiliensis: in *Dep. Agric. F. M. S. Bull.* No. 6.

A lecture on the Para Rubber Tree: in *Dep. Agric. F. M. S. Bull.* No. 10.

A Root Disease of Para Rubber Trees: in *Agric. Bull. S. and F. M. S.* Vol. VII. p. 515.

Annual Report of the Government Mycologist, Federated Malay States, for 1907: in *Agric. Bull. S. and F. M. S.* Vol. VII. p. 588.

Van Hall, C. J. — Robusta and Some Allied Coffee Species: in *Agric. Bull. F. M. S.* Vol. I. pp. 251 and 255.

Lloyd, C. G. — Various references in *Mycological Notes.*

Massee, G. — Revision of the Genus Hemileia: in *Kew Bull.* 1906, p. 35.

Fungi Exotici: in *Kew Bull.* 1898, p. 118. 1899, pp. 168 and 175. 1901, p. 155. 1906, pp. 93 and 256. 1908, pp. 1, 6 and 218. 1909, p. 204. 1910, p. 251. 1911, p. 225. 1912, pp. 190 and 357. 1913, p. 104. 1914, pp. 75, 157 and 357.

Patouillard, M. N. — Sur deux formes conidiennes de Poro-hydnés: in *Bull. de la Soc. Myc. de France,* Tom. XXXIV. 2e. Fasc., translated in *Gard. Bull. S. S.* II. p. 144.

Patouillard, M. N. and C. F. Baker. — Some Singapore Boletinae: in *Journ. R. As. Soc. Straits Branch*, No. 78, p. 67.

Pratt, H. C. — Preventive measures against Black Thread: in *Agric. Bull. F. M. S.* Vol. V. Nos. 5 and 6. p. 180.

Richards, R. M. — As cited in the text in:—*Agric. Bull. F. M. S.*

RIDLEY, H. N. On the so-called Tiger's Milk—Susu Rimau—of the Malays: in *Journ. R. As. Soc. Straits Branch,* XXII. p. 341. Susu Rimau, further Note: in *Journ. R. As. Soc. Straits Branch,* XXXIV. p. 101.

As cited in the text in:—*Agric. Bull. Mal. Penin.,* and *Agric. Bull. S. and F. M. S.*

SACCARDO, P. A. Notae Mycologicae, ser. XXIV. Fungi Singaporenses Bakeriani: in *Bull. Orto Bot. Univ. Napoli,* VI. p. 39, 1918.

SACCARDO, P. A. and G. PAOLETTI. Mycetes Malacensis: extract from *Atti del R. Istit. Veneto di Scienze Lettere ed Arti,* Tomo VI, Ser. VI.

SANDERSON, A. R. and H. S. SUTCLIFFE. Sphaeronema sp. (Mouldy Rot of the Tapped Surface): in *Annals of Applied Biology,* Vol. VII. No. 1, p. 56.

SHARPLES, A. As cited in the text in:—*Agric. Bull. F. M. S.;* and *Dep. Agric. F. M. S. Bull.*

SOUTH, F. W. Buried Coconut Trunks, and Root Diseases of Rubber: in *Agric. Bull. F. M. S.* Vol. VI. p. 269.

SMITH, A. LORRAINE, On a collection of Plants made by H. C. Robinson and L. Wray, from Gunong Tahan, Pahang: in *Journ. F. M. S. Museums,* Vol. II. p. 142.

VINCENS, F. Maladie rose et chancre des branches sur Hevea brasiliensis, dus au Corticium salmonicolor, B. et Br.: in *Bull. Agric. l'Instit. Scient. de Saigon,* 1920, No. 11, p. 323.

WAKEFIELD, E. M. Fungi Exotici: in *Kew Bull.* 1918, p. 208.

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to Fungi of the Malay Peninsula and their hosts.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. II. Issued August 5th, 1921 No. 12.

FORESTS AND THEIR RETENTION OF RAIN WATER.

Fifty years ago a forester named Surell, published a study of torrents in the High Alps (Etudes sur les torrents des Hautes-Alpes 1870), a book that ran to a second edition two years later under the editorship of another,—E. Cézanne. In this work the re-afforestation of bared slopes was advocated as a remedy against landslips and denudation resulting from streams in flood. The book led the way for reports, such as Demontzey's "Removal of torrents in France by re-afforestation" (L'extinction des torrents en France par le reboisement, 1894). Yet, though by the end of the last century the principle had been recognised that forests prevent this kind of destruction, many, some resenting forest regulations, failed to realise their true importance: and therefore in 1900 a demonstration of the influence of forests upon the running off of the rainfall was commenced in Switzerland by that country's Central institute for the study of Forestry. For the demonstration two comparable valleys near Berne were selected; one with forest throughout, the other two-thirds in pasture. Rain guages were installed: and guages put upon the streams that carry the water away. As no arrangements could be made for keeping records at temperatures below freezing point, winter-observations were impossible: but after 18 years of observation in each year from April 16th to November 30th, the results have been published by Dr. Arnold Engler under the title of *Untersuchungen ueber den Einfluss des Waldes auf den Stand der Gewasser.*

The fate of the rain which fell, it is concluded, was:—

	from the forest	from the open
to be run off through the streams ..	60 parts	60 parts
to be evaporated from off the surface of the vegetation	5 ,,	10 ,,
to be evaporated from off the surface of the soil	15 ,,	24 ,,
to be taken up by the roots of the vegetation and thence passed back to the air by transpiration	20 ,,	6 ,,
	100 parts	100 parts

Now the last process takes time and it is obvious that the water so used must be delayed in its circuit: but the chief interest is the rate at which the 60 per cent was run off in the streams. It was run off rapidly from the pasture but slowly from the forest: thus in the springs when the thaw came, the forest allowed the liberated water to escape much more slowly than the pasture: and through the summers when sudden downpours occurred, the stream from the pasture valley for a time would discharge per second twice to thrice as much water as the stream from the forested valley, for the same fall of rain. In times of protracted rain the discharge per second would be something up to twice as much, the difference growing less, the longer the downpour extended; this is as one would expect for every soil has a limit of saturation, beyond which it can retain no more.

It follows from the way in which the first valley parted slowly with the rain that its forest soil must be much more uniformly moist than the pasture soil: but the reason for this is not, as most think, because the forest covering prevents the sun from reaching the soil; but is in the circumstance that a forest soil is absolutely different from one more exposed: it possesses properties for instance which it keeps for a time after the forest is removed, which we refer to when we call it a "virgin soil;" and the most useful of all the properties of virgin soil from a forest is that of holding moisture against the dessicating effects of exposure to the sun.

Several factors assist in bringing this about.

There is more humus in a forest soil than in a pasture soil; and the decay of the humus opens it: there are more roots in a forest soil than in a pasture soil; and they open it: and almost certainly there is an entirely different soil fauna, which brings about enormous differences. Possibly other differences could be enumerated; but the result of all is that forest soil has a porosity lacking in exposed soils, cultivate them as we will.

That the differences observed in the running off of the rainfall from his afforested valley and from his deforested pasture valley are due to the nature of the soil Dr. Engler appears to have no doubt.

The water of the stream from the pasture valley carried more sediment than that from the afforested valley.

Had the Swiss Institute's experiments been a comparison of an afforested valley with a bared valley, how much greater would the contrasts have been; and how much more forcefully would the second stream have poured down in flood, carrying the soil with it.

These Swiss observations have considerable interest in Malaya.

The porosity of a forest soil is well illustrated in the Peninsula by the way in which the peat-lands of Kukob and other low-lying places shrink if exposed for the cultivation of rubber. The steady release of the rainfall by hill forest is pleasantly shown in the early rice crops that the narrow upper ends of the valleys give in Malacca. The consequence of the removal of forest has been obvious enough in the same neighbourhood where the Railway has had to alter its

culverts that were silted up. Perhaps there are no records which would show that the Malacca river is less constant than formerly, but it is more than probable that it is less constant as a consequence of the extensive clearing of the rolling ground about the Malacca-Negri Sembilan boundary.

Virgin forest soils are, in Malaya, most interesting. They can be destroyed in a few years; but it would seem that they can only be build up by several tens of years; perhaps it takes one hundred to restore them. At any rate the real forest trees appear to demand one hundred years§ of preparation before they are again at home. Belukar in all its stages is the evidence of soil unfit for them. What they need and the soil has not got when carrying belukar is probably porosity plus the right soil fauna; and of soil fauna here we are extremely ignorant.

I. H. BURKILL.

SOME TESTS OF GARDEN VEGETABLES IN SINGAPORE—LETTUCES.

If reference be made to this Bulletin Vol. 2, No. 1, 1918, p. 9, a note will be found by Prof. C. F. Baker upon lettuces tried by him in the Economic Garden, Singapore. Since then, other lettuces have been tried, and the last of the experiments done, will be reported on here.

The seed came from three different firms, Messrs. Sutton and Sons, Reading, England; Messrs. Vilmorin, Paris; and Messrs. Dreer & Co. Philadelphia U. S. A. The lettuces of different origin could not be tried against each other, as it was impossible to sow them together, but those from each firm were grown side by side.

The method of cultivation was as follows:—

Soil and site. The soil selected for growing these was of two sorts (1) sandy loam; and (2) rich damp loam obtained from peat by constant cultivation, good drainage, and incorporation of lime. The soil was dug over twice, manured with cow manure at the same time, and then left exposed to the sun. After a week or so, beds 3 ft. broad and long according to the site, were made, and kept ready to receive the seedlings.

As for the sites, they were two: the first was above the zone of floods which have become somewhat frequent in the Economic Garden in the early part of the year; while the second was liable to flood. The first situation answered well while the weather was wet and in the dry spells with precautions, in giving water, keeping a fine dust mulch and giving shade in the middle of the day.

Germination and growth. Soon after the seeds were received they were sown in boxes in a soil with an addition of sand to run off extra water and to prevent damping off. The seeds usually

§ Cf. in the Gardens' Bulletin II No. 5, pp. 145—157, an account of Secondary jungle thirty years old.

took 40-48 hrs. to come up; but if not sown promptly—in some cases, it was not possible to do so—they took longer even up to 5-7 days to germinate. The cause may be sought in weakened vitality which is lost exceedingly early in this hot moist climate.

When the seedlings were 2-2½ ins. high, that was in 7-9 days, they were transplanted into the beds in the afternoon or in cloudy days all the day long, in rows with 9″ between the rows and also 9″ between the seedlings.

A fortnight from transplanting, when the seedlings had taken, an emulsion of cowdung, (1 bucket of dung to 8 of water) was poured in between the rows. Fish manure and burnt earth were also used, but the first was found to be the most suitable, for it is in a more assimilable form. The growth was rapid after this and the salads were uprooted as follows.

Suttons'	after 41 days.
Dreer's	43 „
Vilmorin's	44 „

The weighments showed that the maximum weight was reached 10-15 days later; it gradually rose from ¾ oz. or 1½ oz. according to the type to 2-3 ozs. when the maximum growth was recorded.

Weather did not treat the different sowings equally, for there were constant changes in it from dry to wet, wet weather being unusually prevalent during the first quarter of the year of 1921. The lettuces in the damper situations grew very well in the dry spells; but in wet periods, those on the sandy loam did better. Artificial shade is essential in the seedling stage for 2-3 weeks in varying degree according to the weather to keep off heavy rains as well as midday intense heat; shade also prevents too much evaporation of water from the sandy loam; while in the case of damp soil, it keeps the air in contact with the plants humid.

Almost all strains succumbed to hard rains but least those which have long leaves—cos type—or behaving as cos. In wet periods, most of the lettuces lost much of their foliage.

Another noticeable feature of lettuces, is that, though warranted as Cabbage type, in this forcing climate. they did not behave as such. Many ran to stem; while a few only form loose and all less compact heads. Cos or behaving as cos, were early ones while the other type was later by a week or so.

The lettuces were distributed for opinion to many people, and the following were appreciated.

Suttons'. Ideal, Nonsuch, Early Paris, Golden Ball, and of these there was an unanimous opinion that Ideal and Nonsuch were the best.

Dreer's. Early curled Simpson, Black seeded Simpson, Mammoth salamander, Big Boston, Improved Hanson, Golden Queen, Wonderful.

Vilmorin's. Green Provence. Unfortunately Vilmorin's lettuces were sunk under flood water on 5/5/21 and therefore were not given full trial.

Sorghum Vulgare Millet, Sown on 21st August, gathered 4th December.

The lettuces by growth could be classed as (1) *heavy-type-salads*:—Ideal, Matchless, Iceberg, Mammoth Salamander, Black-seeded Simpson, Way-ahead, Mignonette, Golden Queen, Golden Ball, Algiers; or (2) *light weights.*—Early curled Simpson, Grand Rapids forcing, Trianon self-folding, Wonderful, Nonsuch, and White heart.

Of Suttons' the following showed themselves *early*:—Ideal, Matchless, Nonsuch, White heart, White Golden ball and Early Paris: —of Dreer's, Trianon self-folding, Mignonette, Big Boston, Early Curled Simpson, Mammoth Salamander, Iceberg, Black-seeded Simpson.

Of Dreer's the following showed themselves late: Golden Queen, Improved Hanson, Grand Rapids forcing, Way-ahead, Hitinger's Belmont, California cream butter.

The cost of cultivation is very low as under: and a man can manage one fifth of an acre with ease.

Cost of cultivation for one tenth acre	$40.57
Gross yield per one tenth acre	60.00
Total net income	19.43

G. B. DESHMUKH.

AN EXPERIMENT WITH SORGHUM VULGARE, THE GREAT MILLET OR JUAR, FROM THE BOMBAY PRESIDENCY.

The accompanying plate shows (behind the men who stand in it) a plot measuring 25 feet long by 10 feet, planted with millet at 12 by 12 inches in all directions. The smaller plants in front of the men do not belong to the plot. This millet, which is in ear, is a race raised from seed kindly supplied by Dr. Harold H. Mann, Director of Agriculture, Bombay, as one of the best of the district of Khandesh, its exact origin being the town of Jalgaon in the Tapti Valley. The seed was one of two lots received together, the other being from Ahmednagar, Bombay Presidency.

The two lots were sown in contiguous plots on 21st August 1919, the sowing being done by hand in shallow channels traced along the ground at one foot apart.

Three weeks after, thinning out took place, the pick of the thinned-out seedlings being transplanted to a second plot near by. These operations were both done on the same day for the two lots; and the transplanted plots were also contiguous. It may therefore be said that both races were raised under absolutely identical conditions of soil, of weather and of cultivation. Both races suffered in the same degree from the attacks of the sugar cane borer (*Chilo simplex*) which was found in almost every stem and also from "aphids" and from bird-depredation. Yet the difference of growth and of yield between the two varieties was very remarkable.

A, the Ahmednagar Sorghum ran to leaf: it grew to stems from 8 to 14 feet high, with abundance of leaves but the panicles so small (from 2 to 4 inches in length only) as to be of no account at all, so that as a cereal crop it was valueless, although as a fodder crop, it would have a value.

B, the Jalgaon sorghum, as shown in the photo, varied in height from 4 to 7 or 8 feet, with a full heavy and rather close, but not compact head of grain,* and altogether the crop, as a cereal may be said to be a very profitable one, as the figures below will show.

A fact worthy of notice is that this plant, from a region of India where the rainfall is a light one, has succeeded under very diverse conditions of climate.

Another point which deserves notice is that the plots which were planted from thinnings throve better than the plots raised direct from seed—a fact which upsets the dictum that Sorghum does not stand transplanting well.

The result of this first cutting was:

Sown plot, 142 stems were cut weighing, with leaves 31 pounds; the 142 panicles collected weighed $8\frac{3}{4}$ pounds, after two days drying that is to say that each panicle weighed dry, 1 ounce. The final result was 5 lb. dry grain.

Transplanted plot, 223 stems were cut weighing with leaves 102 pounds; the 223 panicles collected weighed $23\frac{3}{4}$ pounds, afer two days drying, that is to say that each panicle weighed dry 1.70 ounce. The final result was 15 lb. 5.03 oz. dry grain.

As previously stated, the whole crop was attacked by the sugar cane borer, which creeps through the stem and feeds on its substance; the damage done, however, was confined to a small portion of the stem below the seeding head, and, in no case, were the panicles damaged by it: the pest which is very easily traced by the red excretious which exude from its tunnel, was easily dealt with by injecting sulphur by means of a rubber puff into the hole, or by introducing a thin wire through the hole; this either forces it out or kills it.

The panicles themselves were damaged to a small extent by aphids, and by a small weevil, which however gave way after repeated dustings with sulphur.

Birds were the most serious enemies to this crop, and it took all the shouting and tin-beating of a small boy on the watch to keep them off. A very effective device to scare the birds away, a device put up by the coolie himself, was found to be the following:—

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* It is a rule in India that the Sorghums with very compact heads are grown in the wide plains where field joins on to field and there is no forest; while near forest such sorghums as may be grown are commonly those with open panicles. The Jalgaon Sorghum is of neither extreme; for with grains just touching, it combines fine pedicels under them. It has been thought that loose eared races are chosen by cultivators near forests because they are less subjected to bird depredation, but it may be said that they are also suited to a moister climate than the others.

The expanded skin of a flying-fox (after the body had been "scooped" out) was stretched to its full length of wing on a frame of bamboo, half rigid, half flexible, attached at both ends to the tips of the extended wings. The main bamboo. *i.e.* that which extends from tip to tip, is slightly bent, like a bow, so that, when taken hold of by the middle, and moved about, the wings, following the movement of the resilient bamboo, appear as if they were actually on the flight. The contrivance is attached at the top of a pole stuck in the middle of the field; a boy, in the distance, holds a string by which the pole is pulled: at the least tug, the bamboo bends and unbends, giving the skin a flying motion which scares the birds away—at least for a time.

Sorghum is one of the most important cereal crops of the world, its grain supplying a wholesome food which is largely consumed in all Asiatic countries. Estate coolies generally prefer it to "Ragi" (*Eleusine coracana*) over which it has the advantage that its grain can be cooked and eaten whole, whereas Ragi has to be ground into flour: it is also made into bread which is as nourishing as wheaten bread. It therefore commends itself particularly and strongly, at the time of rice and wheat shortage, to the attention of planters.

The returns of land under Sorghum cultivated as a pure crop, are variously given for India, as between 500 to 900 pounds of grain per acre (Watt's Dictionary, Mukerji, Macmillan). The seed in that country is generally drilled in rows 14 to 18 inches apart. The writer as already stated, had his seed sown in rows 12 inches apart, then thinned and transplanted at the same distances, viz: 12 inches by 12 inches.

Given a rich soil, the resulting crop appears to justify the practice of transplanting in this country and although it would be absurd to generalise from such small plots as are here in question, viz: 280 square feet, yet the amount of grain obtained was so much greater, (in the transplanted plot) than the averages given above for India, that it compels comment.

Reverting to the figures of yield previously stated, we found that 280 square feet of Jalgaon Sorghum planted 12 by 12 inches gave in one cutting, the following results:

Transplanted plot, 223 panicles weighing 23¾ pounds yielding 15 lb. 5.30 oz. of dry grain.

Sown plot, 142 panicles weighing 8¾ pounds yielding 5 lb. of dry grain.

The figures for the second cutting, which took place one week later on, by an unfortunate inadvertance, are not available. The panicles were, of course, much smaller, and the weight of grain obtained from them would have affected but slightly the final result. By neglecting them altogether, we shall strengthen our view that

Jalgaon Sorghum firstly may maintain its yielding capacity† under our local soil and climate conditions, secondly that transplanting increases the yield of grain.

Allowing for paths and computing one acre at 40,000 feet. we should come to the following figures:

Transplanted plot: 280 square feet 15 lbs. 5 ozs. of dry grain.

Sown plot: 280 square feet 5 lbs.

One acre—714 pounds dry grain.

In the light of the foregoing averages for India viz. 500 to 900 lb. per acre, the figure for the transplanted plot appears absolutely abnormal; but, then, so was the size and weight of the panicles. One, among the number, weighing $3\frac{1}{4}$ ounces was found after picking the seeds one by one, to give $2\frac{1}{4}$ ounces of seeds, the rachis weighing one ounce.

E. H. MATHIEU.

A NOTE UPON PLANTS GROWN FOR BLUE DYES IN THE NORTH OF THE MALAY PENINSULA.

Within the last few years a little information has reached the Botanic Gardens upon plants raised in the north of the Peninsula for the sake of the blue dye that they yield; and three have been submitted for determination being:—

Indigofera suffruticosa, Mill.
Strobilanthes flaccidifolius, Nees, and
Marsdenia tinctoria, R. Br.

The first two of the three were sent from the state of Kelantan by Mr. R. J. Farrer, the latter two of the three from Upper Perak by Captain H. Berkeley. All three are well known as dye-plants; but as a dyeing industry flickers only within the Peninsula, it is interesting to ask what influence may have brought them into cultivation here.

Indigo cultivation has a long and a very complicated history; and the above named species of *Indigofera* is one only of half a dozen grown in different parts of the world. Indigo, almost certainly imported, was used as a dye in ancient Egypt; for mummy clothes of 2300 B.C. have been found dyed with it. It was prepared in ancient India, and finds mention in the sanskrit writings of about the same period. It was an expensive import of Rome at the commencement of the Christian era, coming from India via Alexandria, and bearing the name "indicum" from its source. It is extremely probable that Ancient Egypt also got its indigo from India.

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† Misfortune attended an attempt to repeat this experiment; for rain fell heavily at harvest destroying the grain; and it is feared that the climate of Singapore in too unreliable for the crop; but in the north of the Peninsula if maturity be aimed at in February the chances of a return would appear good. I. H. BURKILL.

With the sacking of Rome the use of indigo became lost to Europe; but without doubt India still grew it: and it can be shown that the Arabs who brought paper making into Europe and the sugar-cane, brought a knowledge of indigo cultivation at least into Asia minor. Europe, as it had always done in chief part, meanwhile went on using woad for its blue dye; but after a time a little indigo (now of Arabian origin) filtered afresh along the Mediterranean to Italy. And later when Vasco da Gama in 1516 had opened the way to India, the portuguese east indiamen began to bring indian indigo to the great mart of Lisbon. After the Great Armada had been destroyed, and with the ascendency of the Dutch which followed, the cultivation of indigo in Malabar and the Malayan region was encouraged; for trade in it was very remunerative, as for instance, in 1631 when five dutch merchant vessels brought from Batavia into Amsterdam 285 tons of indigo then worth as much as five tons of gold.

From this period dates the eclipse of woad in Europe, but not its extinction; for woad is still used to induce the dyeing with indigo.

Indigo growing even invaded Europe: for a century and more back its cultivation was tried with success in various places, *e.g.* Malta, Sicily, Southern Italy and Spain; and with passable results even in Southern France (department of Vaucluse): but it is certainly not a plant that can be grown economically now that the value it had has dropped to one quarter.

At least three species of *Indigofera* contributed to the early supply; for, while Surat indigo was derived from the cultivation of *Indigofera articulata*., Gouan, the cultivation of indigo in South India would seem to have been of *Indigofera tinctoria,* Linn.: and in the Malay region the Dutch met with *I. sumatrana,* Gaertn., and they interchanged the two latter; they brought *I. tinctoria* to Malaya; while they took *I. sumatrana* to India: and *I. sumatrana* proving the better, they adopted it in both places. They spread it through Malabar and Madras; and when under the rule of the East India Company indigo began to be produced in Bengal, *I. sumatrana* was the species brought into cultivation around Calcutta, whence its cultivation was taken north to Rajshahi and then west to Behar, it becoming the plant of the well known Behar indigo industry. From this beginning for three quarters of a century Bengal went on cultivating the one species. *I. sumatrana,* which the Dutch had brought into southern India so long before.

Europe, however did not draw anything like the whole of its requirements of the dye from the East; but tapped (1) the West Indies and southern of the United States. where at the end of the 17th century *I. tinctoria* was the indigo grown, and (2) Brazil where an American species *I. suffruticosa*, Mill. (I. Anil, Linn.) was brought into cultivation. From the New World the latter found its way into the Malay region, and as the Dutch believed it better than *I. sumatrana* they changed their crop in Java; at the

same time this American *I. suffruticosa* got a footing upon the south coasts of China along with *I. tinctoria*, became also a crop of the neighbourhood of Manila, and would seem to have been the indigo grown by Chinese a little later upon the outskirts of Singapore. And therefore to this date with this, the East had put four species under contribution.

The Arabs when they started the cultivation of indigo in Arabia took for their crop *I. articulata*—the species which supplied Surat indigo; and they established it also in Egypt; but this particular species did not spread to the upper Nile, where *I. arrecta*, Hochst., was or became grown. It may be that the origin of indigo-growing in Africa came from the Arabs; and in any case it is exceedingly probable that ancient Egypt drew its indigo from India and not from the Soudan; but the cultivation of *I. arrecta* has become very wide in Africa; and about 1860 the Dutch got possession of it for Java where it displaced *I. suffruticosa*, but did not hold its ground for long as a second American species. *I. guatemalensis*, Moc. and Sessé, came into favour about 1870. only to be ousted, imperfectly however, by *I. arrecta* coming in again as a consequence of changed methods.

These alterations of the species in vogue in Java, did not in Malaya extend beyond the Dutch Indies: but in India the Behar industry slowly began to follow suite in adopting *I. arrecta* under the name of "Java-Natal indigo."

Singapore gave up indigo-production in the seventies: the Philippine islands lost their export in the nineties: but China remains growing over a limited area on its south-east coasts for its own internal consumption, probably both *I. tinctoria* and *I. suffruticosa*. The last named is the species of *Indigofera* cultivated in Kelantan.

The indigo dye manufactured for the Chinese local markets is sold in paste; and such was that from this species sent by Mr. Farrer.

It is not possible to see a future in the industry, especially as the batik workers in Java who consume a considerable quantity of indigo appear to find the artificial more to their liking; and moreover Kelantan is backward in growing a species now twice superseded in Java—growing it moreover when the war had curtailed the supplies of artificial indigo.

The enormous demand for a blue dye in China is met but in part by the use of indigo; and indigo cultivation seems only to have got a hold in the south-east of the country: elsewhere the blue dye comes from *Isatis indigotica*, Fortune, the Chinese woad, from *Strobilanthes flaccidifolius*, Nees (Ruellia indigotica, Fortune), from *Peristrophe tinctoria*, Nees, and from *Polygonum tinctorium*, Lour. The second of these is the second of the dyes from the north of the Malay Peninsula with which we are dealing.

Strobilanthes flaccidifolius has never found a place in cultivation outside southern China, Indo-china and the adjoining moun-

tainous parts of India; but within its area it has quite an importance. It is for instance said in southern China to be prefered to indigo, both in the vat, and because instead of being a biennial it persists over several years and can be cut repeatedly. It is probably unsuited to the open plains where indigo is grown in India; and no one has had occasion to try growing it upon a plantation scale.

Obviously the Kelantan and Perak cultivation of this species is to be regarded as the southern limit of the range of this interesting crop. It would not be new in those parts, but like the Kedah rice fields, probably established from at any rate the time several centuries back when settled governments ruled between the mouths of the Irrawaddy and the China sea.

The third dye plant, *Marsdenia tinctoria,* R. Br., would seem to show a very different history. Its natural distribution is from the eastern Himalaya and southern China to Borneo and Java; but there is no history of its cultivation in northern India and China. It was first described at the end of the 18th century by William Marsden, who found it in western Sumatra and sent specimens to England when Robert Brown named the genus *Marsdenia* after him. It was brought to notice in Calcutta, and Roxburgh "warmly recommended an extensive cultivation" of it, after trying it in the East India Company's garden. But despite quite a considerable interest taken in it, which interest is very evident from the correspondence printed in the Journal of the Agri-Horticultural Society of India, no cultivation was taken up.

In 1844 it was shown that the Karens; and sometimes the Burmese of Lower Burma grow it: but it is said that they did not consider it the equal of *Strobilanthes flaccidifolius.* It appears to have been grown at one time in Java. Elsewhere it does not appear to have been a crop; and in no place so much a crop as in western Sumatra. Its cultivation therefore belongs to this part of the vorld in a greater measure than that of indigo and of *Strobilanthes flaccidifolius.*

Mr. Farrer describes the preparation of dye from *Strobilanthes* as done thus: the twigs are cut, steeped in water to which lime is added, the water beaten when fermentation has set in, and the precipitated dye subsequently collected. No oil is used, as Fortune says is in the tea districts of China.

I. H. Burkill.

ANOTHER "WET ROT," AND PORIA HYPOBRUNNEA.

About eighteen months ago an old tree of *Spathodea campanulata* that had been blown over in the edge of the Gardens' Jungle within the Botanic Gardens, Singapore, was cut at three feet from the base, and the stump being left in the ground was allowed to coppice. Some dozen strong shoots shot up; but when about

eight feet high they suddenly ceased growing, shed their leaves and died. The base of these coppice shoots at the crown of the old stump was examined and the wood was found to be permeated by yellowish brown lines exactly as in a case of *Poria hypobrunnea.* Upon examination of the stump lower down, the wood of the collar and root laterals was found to be soft and friable. The outer layers of the wood were deeply stained a yellow brown; and under the bark the hyphae of a fungus had collected into a dense felt-like ferruginous mass forming a plate two feet or more in length and up to a foot in breadth. Adjacent was a more advanced stage where the bark had fallen and a fructification forming a plate 16 inches by 12 was exposed. On other parts of the collar the hyphae had spread over the outside of the bark forming stout reddish strands which frequently cohered into narrow plates of hyphae.

The above description and the effect on the wood tallies in a great deal with Petch's description of *Poria hypobrunnea* but the fructification is entirely different. The fructification is resupinate, corky, of a ferruginous brown surface and content, rather darker in the older specimen, 1 mm. thick. The pores are of medium size and irregular, and the contents reduced to a very thin stratum. The setae of the pores are stout, sharp-pointed, 15 to 20 micromillimetres long. Spores are pear-shaped, with a small hyaline mucro, white, darkly opaque, smooth, 6 by 4 micromillimetres.

From the general appearance of the fructification the fungus is related to *Fomes pomaceus,* but its spores cannot be called hyaline. Apart from this factor it agrees with the description and comparison of *Fomes pomaceus.*

On a recent visit to Mr. G. E. Perry, Mycologist to the Société internationale de Plantations et de Finance de Caoutchouc, a specimen of *Poria hypobrunnea* and its effect on rubber trees were seen. Owing to the remarkable similarity of the above fungus except in fructification, and of its effect upon the wood, specimens were shown to Mr. Perry, who in reply forwarded the following note upon *Poria hypobrunnea.*

"*Porea hypobrunnea in Malaya.* In the past there has been considerable confusion between two root diseases attacking *Hevea brasiliensis, Poria hypobrunnea,* Petch, and *Poria hypolateritia* (now known as *Fomes pseudoferreus*). They were at one time even considered one and the same disease, even though the descriptions published by the Ceylon and F. M. S. scientists were at variance. *Fomes pseudoferreus* has been quite prevalent in Malaya, some estates being badly infected. The old name, *Poria*, is still used by the planting community for this saturated spongy condition of the roots, hence the confusion.

Through the kindness of Mr. T. Petch, Government Botanist and Mycologist, Ceylon, specimens of *Poria hypobrunnea,* were sent to this Department for our museum collection of disease specimens. This *Poria hypobrunnea,* Petch, which heretofore was not definitely known to exist in Malaya has since been found both in Selangor and

Perak. An infected stump sent in to this Department for examination exhibited unmistakable characteristics of the root disease. Further examination of the spot from which the tree had been removed, shewed more advanced stages of the infection on the few remaining laterals. On a recent visit to an estate in Perak, the writer found a similarly infected tree, the roots showing the characteristic red mycelial strands and plates adpressed to the surface. In the writer's belief, these are among the first instances of the disease being found and identified in Malaya.

A very good description of this disease was published in the *Tropical Agriculturist,* Vol. LII, No. 1 by Mr. Petch. He states in part that the appearance of the diseased roots is very variable and in consequence its diagnosis is in many cases difficult. On young trees its identification is fairly easy. The tap root then usually bears external mycelium in a more or less young stage and in that condition it is unmistakable. The mycelium forms stout red strands on the exterior of the root which sometimes unite into a continuous red sheet. The strands are smooth and tough on the outside and vary in colour from bright red to brownish red according to age. Frequently, adhering to the root, are found very small stones and fine gravel, but not so encrusted as with Brown rot disease. The appearance of the diseased wood is also typical in the case of young trees. It is somewhat soft and friable and permeated with red sheets. These sheets often run in cylinders in the wood along lines of the annual rings. On older trees the indications are by no means so clear. The roots which have been longest diseased are generally soft and wet and on these there may be a net work of narrow white threads between the bark and the wood. The fructification may sometimes be found at the collar of the diseased tree, or along the underside of exposed lateral roots. It forms a flat plate closely applied to the surface of the root or stem. At first it is yellowish white; it then changes to reddish brown and finally to a dark slate colour. Its thickness is usually about one and a half millimeters and it may spread over an area of several inches.

There is no doubt that the disease spread originally from jungle stumps. Its recent appearance on rubber estates, about twelve years old, where it was not previously known, is probably to be attributed to the way in which the thinning out was done. It had been found to develop from the stumps of the felled *Hevea,* where the trees were cut down to ground level and the stumps left to decay, and is one of the most regular frequenters of rotting *Hevea* logs. The spread from tree to tree is usually by direct contact of the roots: however it has been demonstrated that the mycelium of this fungus can travel from the diseased roots for some little distance through the soil. With regard to the rate at which the disease progresses, the following may be noted:—*Hevea* was planted on newly cleared land in June 1913; the trees began to die in 1914: that is quite as rapid as any other root disease.

The treatment of *Poria hypobrunnea* follows the usual lines, but it is especially necessary that all *Hevea* logs should be removed as the fungus develops chiefly on them.

The recent appearance of this disease in Malaya should not be viewed with alarm, as in all probability it has been prevalent for some time, but until now has not been identified as *Poria hypobrunnea*."

It would appear that the symptoms are caused by even more than the two fungi mentioned,* *Poria hypobrunnea* and *Fomes pseudoferreus,* although the present record is not from a Para rubber tree, but from another tree, exotic in Malaya, but not a native of the continent which has furnished the Para rubber tree to Malaya.

T. F. CHIPP.

THE MELON FLY, BACTROCERA CUCURBITAE.

The melon fly, *Bactrocera cucurbitae,* found its way into the Hawaiian islands in 1895 and there did such serious damage that Melon growing became impossible. To combat it, the Board of Agriculture and Forestry for Hawaii, sent their Entomologist Mr. David T. Fullaway, to the East in 1917 to seek for insects that prey upon the fly. In the course of his tour he visited Singapore, and soon located Bactrocera near the town in a Chinese vegetable garden; and by breeding out the insects he obtained three individuals of a parasite of the genus *Opius.* This was a first step on the road: but he got no more though he reared in captivity 6000 of the flies. Proceeding to Java he found the same *Opius* on the melon fly, and in slightly larger numbers: later on reaching India he got it again about Bangalore. This parasite, *Opius fletcheri,* he conveyed to the Hawaiian islands and turned loose in the neighbourhood of Honolulu. It has done its work to such an extent that in the "Hawaiian Forester and Agriculturist" for April 1920. Mr. Fullaway reports it to destroy 50% of the melon flies, and that "it is again possible to grow melons successfully."

It is very probable that the melon fly is the limiting factor to Melon cultivation in the Straits Settlements: and the occasional successes with melons that reward enterprising people are in that case chiefly due to the Melons being grown out of reach of the fly. Its connection with wild gourds has not been studied.

I. H. BURKILL.

THE COHUNE NUT.

The recent fruiting of the Cohune palm, believed to be its first in the Malay Peninsula, calls for more than a bald record.

With this object in view the following notes have been prepared and give (1) a short description of the plant, (2) its native habitat (3) its uses, so far known, (4) the results of analysis of the

Cf. Belgrave, A wet of rot Para Rubber Roots, in Department of Agriculture, F. M. S., Bulletin No. 28.

Nut and difficulties in oil extraction, (5) its possibilities. The plants mentioned above, as having fruited, are situated for the most part in the Botanic Gardens, Singapore; but two of a row of four plants in front of the Raffles Museum, Singapore, have also fruited. These plants are all about the same height and were probably raised from one particular batch of seeds, several consignments of which have been received and successfully raised at the Botanic Gardens, at various times. In view of this it can be safely assumed that all the plants now fruiting are of the same age. No record has been found to indicate the exact age of the trees, but as a result of careful enquiries it has been established beyond doubt, that they are from 25 to 30 years old. Care has been taken to avoid understating the age, in order that experiments from a commercial point of view, should not be attempted under a misapprehension as to the length of time which must elapse between the time of sowing the seed and the fruiting period.

Up to the latter of part of 1918, the plants of *Attalea Cohune* in the Botanic Gardens, Peradeniya, Ceylon had not produced fruits.

GENERAL DESCRIPTION OF THE PALM.

Attalea Cohune, Mart.—the Cohune Nut Palm. A magnificent feather-leaved palm which attains a height of about 40 feet. In the ordinary way the old leaves are cut off and the leaf bases remain on the stem giving it a very rugged appearance. These leaf bases afford a firm footing for ferns, etc., which when established are very ornamental and in the Botanic Garden the palms are so kept. When the leaf bases are thus allowed to remain the stem takes on quite a distinctive shape At the base it is from 1-2 feet through and gradually thickens upward until at the crown it becomes fully 4-6 feet through. The effect thus produced is certainly striking as the stem is three times thicker at the top than at the bottom. In a specimen from which the leaf bases have been removed the trunk is smooth and cylindrical, there being little difference in size the whole way up. The leaves are produced abundantly at the top of the trunk, are fully 20 feet in length and form a magnificent crown. The pinnae are placed close together on the rhachis and are held more or less rigidly at right angles to it, thus giving a flat surface to the leaf. The leaf becomes twisted at a short distance from the base with the result that the pinnae of the upper three quarters of it have their edges towards the light instead of their faces. as in the older leaves of the majority of the palms. Also, about two thirds of the way up, the rhachis makes another bend, producing a very gracefully curved upper part to the leaf. The inflorescences are produced in the axils of the leaves in fair quantity and are at first enclosed in large tough fibrous spathes from 5 to 6 feet long and $\frac{1}{4}$ inch in thickness. These latter are more or less boat shaped and extend at the apices into horn like structures about two inches in length. They soon split longitudinally on the upper surface and remain during the flowering and part of the fruiting period. Apparently they play

a dual role, at first that of enclosing the tender spadices and later when open protecting them from rain. The spadix is almost the same length as the spathe and bears numerous simple branches, arranged more or less spirally, the longest of which does not exceed 1 foot. The peduncle is about 2 inches thick, is somewhat flattened and the upper half only bears the flowering branches. The latter are more or less uniform in length and are quite thin. Flowers are produced in large quantities on the spadix and are yellowish in colour. Sometimes a spadix bears either all male or else all female flowers, in which case the spadix is dioecious: and sometimes a spadix produces separately both male and female flowers, in which case it is monoecious. Occasionally a few hermaphrodite flowers make their appearance. The male flowers are considerably smaller than the females and in monoecious spathes are borne on the upper parts of the spadix-branches while the female flowers are borne on the lower parts. The fruit is ovoid and large being about 2½ inches long and proportionately broad. A small projection occurs at the apex which originally bore the stigmas of the female flowers: the outer skin or pericarp is fibrous and woody, while the inner skin or endocarp is very hard and bony. These enclose the seed or nut which contains an oil of considerable value.

Habitat. The native habitat of this palm is in tropical America: in British Hoduras, it covers huge areas in the form of a natural stand. It is found in low lying parts and produces enormous quantities of fruits.

Uses. So far the palm has not been put to any extensive use. Beyond its local uses it does not yet rank in importance with its relatives the Coconut and Oil Palm. A note in the Annals of Botany XII p. 165, mentions the use of the Cohune Nut in the coagulation of rubber. By exposing a thin layer of Para or Ceara latex to the action of the smoke from the burning shells coagulation is immediately brought about. In this case the species mentioned is *Attalea excelsa*: but doubtless *Attalea Cohune* can serve the same purpose.

The following is an extract from the Gardeners' Chronicle (LXVIII. 1920, p. 211) and seems worthy of repetition for the peep behind the scenes and because it emphasises the important part which science played in the Great War.

"*Attalea Cohune*—the hard shell of the Cohune Nut of Honduras, the fruit of the Manaca Palm, was found when carbonised to give protection against poison gases in the war."

Results of an Analysis of the Nut and the Difficulties in Oil Extraction.

A careful analysis of the seeds has been made at the Imperial Institute and the results are recorded in the Bulletin of the Imperial Institute (1913). The conclusion arrived at is that as an oil palm *Attalea Cohune* is a very valuable plant. The analysis showed that "Cohune kernels" yield about the same per-

centage of fat as copra and rather more than palm kernels and it is considered that in the market, the oil should fetch about the same price as coconut oil and palm oil.

There are certain difficulties in dealing successfully with it, the chief of which are (1) the exceptionally hard nut which necessitates special crushing apparatus and (2) that experiments with mechanical crushing show that the kernels bruise very easily and during transit to any distance the oil in them becomes rancid. The latter is under further investigation and it is probable that the difficulties will be overcome successfully in the near future.

Possibilities. The possibility of the palm ever being of any economic value in this country seems improbable, owing to the length of time needed before the plant becomes sufficiently mature to produce fruits. When once this stage has been reached the yield seems fairly regular and no doubt on a large area sufficient fruits could be obtained to make it a paying concern. Until it can be made to produce fruits at an earlier age it is of no value in Malaya. It seems to be a subject for further investigation and if data could be obtained from British Honduras dealing with yield and age, the question could quickly be settled as to whether it would be worth while experimenting with a view to shortening the period needed for fructification or not worth while.

The note dealing with the use of Attalea nuts in the coagulation of rubber, points to two possibilities:—(1) the extraction of oil from the kernels and (2) the use of the hard shell for coagulating rubber, provided *Attalea Cohune* and *Hevea brasiliensis* could profitably be grown in close proximity. The latter point is open to criticism in that a certain amount of oil of an inferior quality can be extracted from the shells and with the mechanical problems solved no doubt this would be extracted and placed on the market. Which of these two procedures would be most profitable it is not possible to state and can only be determined by actual experiment. It may be mentioned in passing that as *Attalea Cohune* grows in low lying land, there would appear to be a use for the low-lying swampy portions of land often found on estates and which are put to no practical use. This however, all depends upon the question of shortening the period between the sowing of the seed and the fruiting stage, so far as Malaya is concerned.

F. FLIPPANCE.

THE BRAZIL-NUT TREE IN SINGAPORE.

In 1911 Mr. W. J. Young, discussed the Brazil nut in the Pomona College Journal of Economic Botany, 1, pp. 122-134, and came to conclusions which are questionable. It is convenient to introduce the subject in his own opening sentences. "The genus, *Bertholletia,* to which is assigned the Brazil-nut of commerce, was

established in 1808 by Humboldt and Bonpland, who placed in it a single species. *B. excelsa.* A translation of Bonpland's description of the fruit of this species follows.

Fruit a spherical compound nut of the size of a child's head and often larger, divided internally into four cells each of which encloses several nuts; covered on its exterior with a husk of green colour, smooth and shining.

Main nut very solid, rough and marked by the branching furrows on its outer surface, 6 lines (1 cm.) thick, divided internally into four cells by as many membranous dissepiments which become obliterated in part or entirely after the maturity of the fruit but of which there always remain traces.

The tree is described as 33 m. high (110 ft.) with a trunk 9 dm. (3 ft) in diameter. Leaves alternate, oblong, subcoriaceous, 1 dm. (4 in.) broad and 6 dm. (23½ in.) long, borne on short petioles. Type locality. Rio Orinoco.

On account of the great height of the trees these botanists were unable to obtain the blossoms although it is said that they offered in vain an ounce of gold for specimens. On this account they were uncertain as to the position which the genus *Bertholletia* should occupy in the vegetable kingdom."

In 1855, Berg, monographing the Brazilian Myrtaceae within which order the genus *Bertholletia* falls, gave a new description, which Miers (Trans. Linn, Society, London, Vol. XXX, 1873, pp. 161) was quick to see diverged from Bonpland's and Humboldt's. Thereon, he made two species. *B. excelsa,* Humb. and Bonpl. and *B. nobilis,* Miers, the latter being *B. excelsa,* Berg.

He followed the first authors and ascribed the origin of the Brazil-nut of commerce to *B. excelsa* rather than to *B. nobilis.*

But in 1911 Mr. W. J. Young (in the Botanical Gazette. lii. pp. 226-231, and in the Pomona College Journal of Economic Botany. pp. 122-127—I have only seen the latter), from an examination of consignments, at the United States ports, of fruits, declared Miers wrong and that *B. nobilis* is the origin of the Brazil-nut of commerce; he states:—

"Commercial samples of Brazil-nuts contain in larger or smaller numbers, opercula derived from the fruit and the presence of these in itself is evidence that the nuts were derived from *B. nobilis,* since as had been noted (earlier in his paper), the opercula fall from the mature pyxidia of *B. excelsa* and hence would not find their way into the sample of nuts from that source. On the other hand their presence in the nuts from *B. nobilis* is perfectly normal and what would be expected since in this species the opercula fall into the interior of the pyxidia and become mixed with the nuts. They vary in form from ovoidal bodies to cones of varying slope and all provided with a distinct apical point.

Every pyxidium of the Brazil-nut the writer has examined, has indicated that the fruit is that of *B. nobilis.* Their main

points of structure are well shown in the figures......which illustrate pyxidia obtained from different sources. Comparisons of the photographs with Miers description of *B. nobilis* will leave no doubt of their identity. Most, if not all, of the pyxidia which the writer has examined were brought to this country by the importers of Brazil-nuts and represent the source of the nuts in which they deal."

In 1914, Dr. T. Petch, in the *Annals of the Royal Botanic Gardens, Peradeniya,* V. pp. 421-431, as a result of study of a living tree controverted Young's statements, concluding thus:—

"It is evident that the Peradeniya tree in many respects combines the characters of the two species. The foliage is that of *excelsa,* and the shape of the pyxidium is that of *excelsa,* though the opercular openings are those of *B. nobilis.*"

On the whole, though conclusions based on a single tree can scarcely be regarded as valid, it would appear that this Peradeniya tree affords strong ground for the suggestion that there is, after all only one species of *Bertholletia.*"

It is proposed here to give the results of an examination of the trees in the Economic Garden, Singapore, chiefly of the two older trees.

The Ceylon plant was introduced from Kew, in 1880: in 1881, Singapore received plants also from Kew: a common origin of the older trees is, therefore, possible. Observations on the two older Singapore trees are below. The third and younger tree would have a different origin.

In the Singapore trees the characters assigned as identification marks to Miers' two species are mixed and the proportion of characters said to belong to *B. nobilis* are to those said to belong to *B. excelsa* as 8 : 5.

From the examination of the fruits only, upon which Mr. Young has relied, our trees will fall into the species. *B. nobilis* and not into the species *B. excelsa*: but from other marks the conclusion holds that there is only one species.

SUMMARY OF THE CHARACTERS.

1.	Height: diameter ratio:: 36.4 : 1; 47.3 : 1; 42.5 : 1.	excelsa.
2.	Trunk bare up to about (1) 25 feet; (2) 30 feet; the third tree 10 feet	nobilis.
3.	Leaves dark green when old, young *rufescent*	nobilis and excelsa.
4.	Petiole is up to 28 mm. long	excelsa.
5.	Panicles 10.5 inches long, with 3-6 side branches horizontal and then becoming parallel	nobilis.
6.	Floral nodes 0.5 inch. apart	nobilis.

7.	(*a*) Pyxidium globose	nobilis.
	(*b*) Pyxidium elongated	excelsa.
	(diameter of the fruit according to the size of the fruit)	
8.	Cortex of the fruit rough, thick and much lenticellated	nobilis.
9.	Opercular opening small, widening considerably inwards; or with nearly straight walls narrowing slightly at the inner end ..	Mixed excelsa and nobilis.
10.	(*a*) Operculum conical with a sharp point; (*b*) Operculum cylindrical flattened at the top	Mixed excelsa and nobilis.
11.	Calyx tridentate	excelsa.
12.	Cortex of the fruit cracks but does not peel off if the fruit is handled	Mixed excelsa and nobilis.
13.	Operculum falls into the cavity of the fruit	nobilis.
14.	Cavity of the fruit unicellular on withering of the septa	nobilis.

G. B. Deshmukh.

THE CORRECT BOTANIC NAMES FOR THE WHITE AND THE YELLOW GUINEA YAMS.

In the Gardens' Bulletin (this volume No. 3, 1918, pp. 87-91) short notes were given upon the above named two West African Dioscoreas, being important foods of many millions of Negroes. In it the identity of the second with *Dioscorea cayenensis* was stated; but no latin name was used for the first; and the purpose of returning to the subject here is to suggest that it is *D. rotundata,* Poiret (Encyclopédie méthodique, supplement, vol. III, 1813, p. 139). *D. rotundata* was described upon a specimen from the New World: but that Poiret could arrive at describing an African plant as West Indian is very easily understood.

The White Guinea Yam is grown in West Africa from Sierra Leone to Angola in great quantities. It is in the ground for eight months of the year, at the end of which period the dug tubers are stored in racks in the villages for consumption as long as they can be got to rest.

Having a wide area and great importance, it is raised in a considerable number of races, nineteen of which, grown in Nigeria, are figured here from photographs taken by Mr. J. Hutchinson of the Royal Botanic Gardens, Kew. Some of these races are earlier than others, and used for prolonging the season; some are more palatable; some heavier yielders, etc.: but of their qualities at present indications only are available.

NIGERIAN YAMS.

Plate XXVI.—Nigerian Yams.

1 OLOTUN IYAGBA (White Guinea Yam)
2 EFIAN (Yellow Guinea Yam)
3 EBA EDI (Dioscorea dumetorum)
4 OBUBIT IWA (Dioscorea dumetorum)
5 AKPANA (Dioscorea dumetorum)
6 NDISIME IWA (Yellow Guinea Yam)
7 SAJA (White Guinea Yam)

UPPER ROW.

8 AGOGO
9 AFIA OKO
10 OKPO UMAN
11 IHOBIA
12 OLOFERE
13 ALAOKO
14 OTUK OKPO
15 AGA

MIDDLE ROW, all the White Guinea Yam.

16 OKO
17 OKPURU
18 KANGE OJINLAJA
19 LAYINBO
20 AGAKE
21 IGUN
22 DODORO
23 NDIAHI
24 OLONKO

LOWER ROW, all the White Guinea Yam.

In the wetter regions of the Nigerian coast and adjacent parts, the Yellow Guinea Yam gets some of the importance of the White Guinea Yam; because as it grows through the whole year, never resting, it is peculiarly suited to those equitable parts, and the tubers can to a certain extent be dug as wanted. These tubers will not keep. It has not got the same great number of races that the White Guinea yam has.

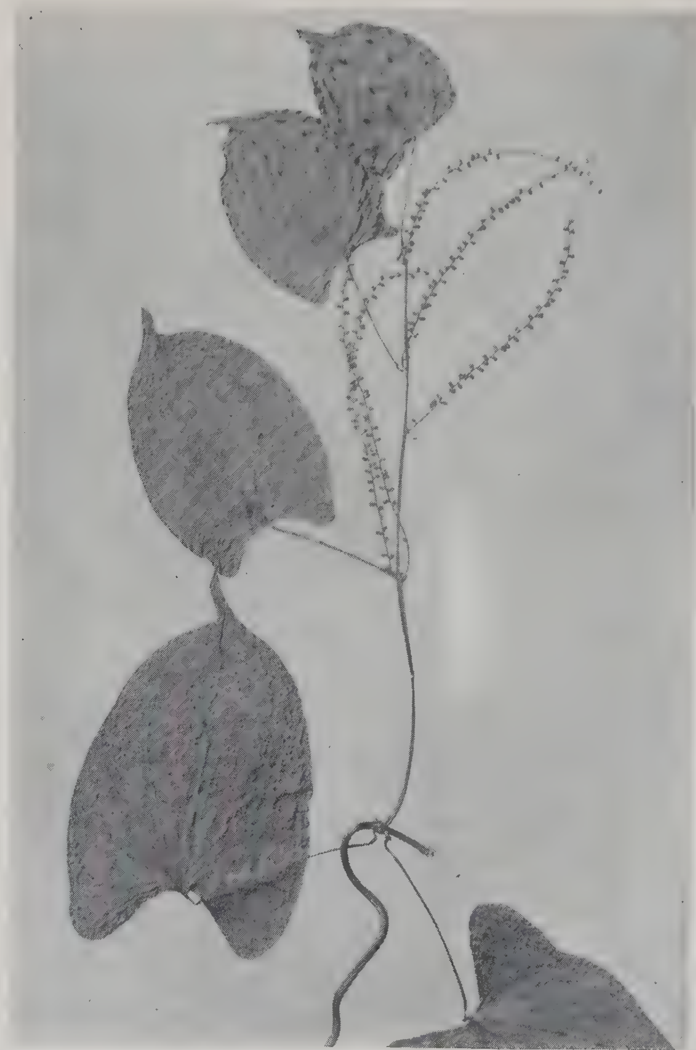
Both the White and the Yellow Guinea yams were early taken to the New World, as also was the Indian *D. alata*,—whether for the first time independently of the slave trade, or in the course of that trade cannot now be ascertained; but this is well attested, that yams were shipped with the negroes as provisions for the voyage whether to Lisbon for proceeding thence to America or to America direct: and among the various names applied to them in the West Indies to this day are certain distinctly reminiscent of the custom, such as Negro Yam, Guinea Yam and Lisbon Yam. The proper application of these names would seem to be, Negro Yam to the White Guinea Yam, Guinea Yam to the Yellow Guinea Yam. and Lisbon Yam to certain races of *D. alata*, but there are inconsistencies in modern usage. The last named was probably in West Africa before it was in America, for Marcgraf writing in 1648 called it the Inhame de S. Thomé or Yam of St. Thomas' island, the said island being off the Gaboon coast.

Because of their keeping qualities, the White Guinea Yam and *D. alata* were better for provisioning ships than the Yellow Guinea yam; but the last had the advantage of being available almost through the year. The three kept a proportionate importance in the West Indies, and nothing could be more natural than that botanists should make acquaintance with them, though two are African, in America. Thus it happened that Lamarck in 1789 described the Yellow Guinea Yam from Guiana under the name of *Dioscorea cayenensis*, and Poiret in 1813 described from a West Indian specimen a *D. rotundata*. which as far as his inadequate material and incomplete description show, can be considered as the White Guinea Yam. The description not sufficing for a clear understanding, Grisebach in his *Flora of the British West Indies*, 1864, p. 587, set down the latter as a variety of the former, a place which it has occupied since, and in which Sir David Prain and the writer left it, when discussing in the *Kew Bulletin* 1919, p. 364, *Dioscorea sativa*. But subsequently the photographs here reproduced, of types of both names, as they exist in Desfontaines' herbarium,, were obtained, and in correspondence between Professor E. Chiovenda, who has charge of that Herbarium, Sir David Prain and the writer, the conclusions have been reached that Poiret had before him a branch of the White Guinea Yam when he drew up his description of *D. rotundata*; and that therefore, no older name existing, the White Guinea Yam is to be so called.

The identity of the Yellow Guinea Yam with *D. cayenensis*, Lamk., has been asserted already by Dr. August Chevalier in the *Bulletin de la Société botanique de France*, IX, 48, fig. 3 bis, where

The folded foliage of the White Guinea Yam.

The flatter foliage of the Yellow Guinea Yam.



Dioscorea rotundata, Poiret (*on the left*), and D. cayenensis, Lamarck (*on the right*), as represented in Desfontaines' herbarium at Florence.

is a picture of a type existing in Lamarck's own herbarium. Those who have access to that portrait will observe how closely it corresponds with the portrait here given.

Lastly as a contribution to the better understanding of the two species a third plate is added here showing the distinctive pose of their leaves.

I. H. BURKILL.

HIBISCUS SABDARIFFA, VAR., ALTISSIMA.

In the Gardens' Bulletin opposite p. 244 of part 7 of this volume *Hibiscus Sabdariffa*, var., *altissima* was illustrated; and the remark was made on p. 243 that the fruits are too small and on account of their hairs little suited for making jams and jellies.

The variety is indeed a fibre plant and not a food plant, and as such should be experimented with in this country. At a recent date its fibre offered on the London market as Bimlipatam jute was worth £45 per ton.

Bimlipatam is a small port in the Madras presidency just south of the great Bengal jute area, where *Hibiscus cannabinus* is the local fibre plant and is grown plentifully in lines among other crops, retted and the fibre marketed. The fibre is slightly stronger than jute, but because the supply is used up along with jute gets the same price as the first marks of jute.

Hibiscus Sabdariffa being a species closely allied to *H. cannabinus*, it is not surprising to find in its tall variety *altissima* characters as to fibre which are common to both: and excellent fibre has been prepared in the Economic Garden, Singapore, by Mr. Mathieu, and valued in London, by the kindness of Professor W. R. Dunstan, at the figure above. The process used was retting.

I. H. BURKILL.

ORCHID NOTES.

BULBOPHYLLUM LIMBATUM, Lindl.

In 1840 Lindley described as *Bulbophyllum limbatum* a small orchid which had been grown in Messrs. Loddiges' horticultural establishment at Hackney, near London. He recorded its origin as Singapore: and at the same place (*Botanical Register*, XXVI. 1840, Misc. p .74) he described several other orchids from Singapore to which the further record is added that they were "received from Mr. Cuming." These others are all well-known to grow wild in Singapore: but *B. limbatum* had not been seen again until last year.

Hugh Cuming was a great collector, who visited our coasts upon his way to and from the Philippine islands in 1835 and 1839. Although it is not expressly stated in the *Botanical Register*, it is

almost certain that it was he who took the *Bulbophyllum* to Britain; and as the other orchids are all species found locally in Singapore, the probability is that the Singapore forests and not the Singapore port, furnished it. The new locality at which it has been obtained is Kotah Tinggi in Johore, and the finder Mr. H. Leu Jeppesen, of the Mount Austin Estate.

Lindley's description, slightly modified, appears in Sir Joseph Hooker's *Flora of British India,* V. 1890, p. 763. and in Mr. H. N. Ridley's *Materials for a Flora of the Malay Peninsula, Monocotyledons,* I. 1908, p. 69. It is now possible to add to it.

The pseudobulbs were described from dried material by Sir Joseph Hooker as depressed subglobose: they are when fresh obturbinate. The leaf which has not been described is almost narrowly elliptic, being by but a little more rapidly narrowed below than above; it is 9 cm. long by 2 cm. wide, solitary, on a petiole 1 cm. long. The inflorescence may exceed the four inches of Lindley's description, and be 15 cm. long: upon it Mr. Jeppersen has seen as many as 12 flowers. The flowers give the impression of being of a dark claret colour; in detail they are thus. The centre within about the base of the column and of the petals is chrome yellow; this becomes paler outwards and tinged with lake on the sepals and petals under their purplish-chocolate margin. The dorsal sepal has three relatively wide purplish chocolate bands down it, which become somewhat interrupted towards its base; and the lateral sepals have five. Their margins are finely pubescent. The petals have one band running into the margin: they are half as long as the sepals. The lip is liver-coloured, paler below upon a triangular margined area with its base the hinge; this area has microscopic purple spots: there is a margined narrow groove on the upper surface extending nearly to the tip, with a chocolate border at the base. Seen from below the lip is elliptic-ovate; from the side it looks exactly like an ox-tongue in the same position; from above the groove makes it subcordate: it all but equals the sepals, and is distinctly mobile. The horns of the column project upon either side of the anther in the same plane as the column.

Eulophia macrostachya, Lindl.

Eulophia macrostachya, Lindl.. is an addition to the Flora of the Malay Peninsula. Though an orchid of unusually wide distribution, it had remained unknown as occurring in the Peninsula until last year. It was found on a limestone hill near Sungei Siput, in Perak, and was brought into the Botanic Gardens in Singapore where it flowered in October.

In 1919 it was received in the Gardens from the Tambilan islands which are between Singapore and Borneo: and it is known to occur in Ceylon, up to 4,000 feet, in Travancore and in the Nilgiri hills, in Sumatra, Java, Ternate, Mindanao and Leyte. In 1889 a plant of it of unknown origin flowered in the Singapore Gardens.

Spathoglottis affinis, de Vriese.

Spathoglottis affinis, de Vr., is a second addition to the Flora of the Peninsula. This beautiful little terrestrial orchid, hitherto known only from the mountains of Salak and Tegal in Java, was found in 1919 by Mr. Mohamed Haniff on Kedah Peak, and has since flowered freely in the Waterfall Gardens, Penang.

The specimens were referred to Dr. J. J. Smith of Buitenzorg for confirmation of the name, and he writes that he regards it as correctly named *S. affinis,* but that the side lobes and the claw of the midlobe are much narrower than in the Javanese plant, and that the callus too is thinner.

Acanthephippium sylhetense, Lindl.

In the Gardens' Bulletin II, No. 2, 1918, p. 44, the genus *Acanthephippium* was added to the flora of the Malay Peninsula; since when a second species has been found south of the isthmus of Kra,—this one in the Siamese Malay States. The second species is *A. sylhetense,* Lindl., which was brought alive into the Waterfall Gardens, Penang, by Mr. Mahomed Haniff from Bukit Khaw Poh near Kasum.

The flowers of the plant from Siam are few, and just before opening they are 1½ inches long from the tip to the base of the bucket, with a maximum width of ⅝ of an inch. They are creamy white with yellowish lines where the sepals meet. They commence their opening, by splitting between the lateral sepals, and then give off a faint pleasant scent. The tip of the labellum can be seen in the opening. With further expansion the lateral sepals become obliquely revolute making with each other a wide V. The petals outgrow the dorsal sepal and stand forward beyond it slightly. The free parts of the sepals and petals are minutely dotted with a pink, which on the inside of the lateral sepals is somewhat collected into five bands, the lowest (nearest to the line of contact between the two sepals and so under the labellum) being very faint. The labellum has the inverted saddle shape so characteristic of the genus; the side lobes which make the side flaps being of a flattened axe-shape, the midlobe is tongue-shaped and curves downwards. It is of a clear buttercup yellow, and so is the part of the limb behind it, where are three crests, the lateral double toothed at the back. The rest of the inside of the flower is creamy white, except that it is suffused with yellow in the base of the bucket.

Lindley's description of *A. sylhetense* says that it is inodorous, gives the flowers a slightly greater size, and mentions no colour but white. But he himself later united Griffith's *A. ringiflorum* to his *A. sylhetense*; and Griffith says of *A. ringiflorum* that the white sepals and petals are spotted within with reddish purple, particularly towards their apices and that the linear concave stalk of the labellum is yellowish as also the mid lobe of the lip, which characters are found in the Siamese specimen. Griffith says that there are 5

crests on the labellum, 2 confluent; such a view is quite reconcilable with the one saying that there are 3 crests, the latter with two teeth at the back.

GASTRODIA MALAYANA, Ridl.

Gastrodia malayana,—an interesting leafless orchid has been found newly in Penang by Mr. Mohamed Haniff in a specimen 32 inches high. Such a height is far in excess of what it is known to reach in Singapore and neighbouring parts of the State of Johor.

I. H. BURKILL.

NOTES.

A POSSIBLE ANCIENT MIGRATION OF USEFUL PLANTS WESTWARD IN ASIA.

In a very interesting account of "The origin and ethnological significance of Indian boat designs" (*Memoirs Asiatic Soc. Bengal,* VII. 1920, p. 139-256) Mr. James Howell suggests that a boat-using community once occupied the coasts of Southern India which was of Negrito stock, and this was followed by a proto-Polynesian stock, and then by the Malaysian wave which reached Madagascar. Later the Dravidians came into Southern India and Ceylon from the Mediterranean by land, and completely absorbed the sea-going people whom they found already there.

These suggestions are worth remembering in connection with the migration of useful plants: the coconut for instance may have reached India by the agency of the second stock.

UNDER-SEA MEADOWS.

Professor W. A. Herdman's remarks in the Journal of the Linnean Society of London, Zoology, XXXIV, 1920, pp. 256-258, upon the great economic value of the seaweed meadows of the Irish Sea are most interesting. Firstly he touches upon the zone of the Brown Seaweeds, concluding "that a very large amount of organic food must be present" in it, and "it is not surprising that shoals of young fish are found feeding there." In the second place he turns to the green Grass Wrack (*Zostera marina*) which lives on muddy sand up to high water mark. The Zostera bed, says Professor Herdman, is an important source of food to fishes and invertebrate animals, "its waving forest, clothed with many other organisms, large and small, is one of the densest masses of living plant food......in the sea, both directly from the food that it furnishes to the animals living in it, and indirectly from the enormous quantities of Diatoms which cover its decaying leaves."

In the seas of Malaya the brown seaweeds are unimportant: but not so the undersea meadows of the tropical Grass-wrack. *Enhalus.*

whose large loose meadows are the grazing grounds of the Duyong, and are frequented by we scarcely know what fish. In the study of them, the sea offers a wide and a most interesting field.

The size of a first class Botanic Garden.

Very interesting is the evidence taken by a Committee (the Joint Committee on the Library, Congress of the United States) on the proposal to establish in Washington a National Botanic Garden. The Committee meeting on May 21st, 1920, heard a number of eminent men, the second to give evidence having been Dr. N. L. Britton, Director in chief of the New York Botanic Garden:—

Senator Knox. "I would like to ask......what would your judgment be as to an adequate area for a botanical garden such as the United States ought to maintain here at the Capital?"

Dr. Britton. "I should think you ought to have at the minimum four or five hundred acres. You ought to have that to develop an institution which would meet the necessities.

Senator Knox. What is the area of the New York Garden?

Dr. Britton. We have about 394 acres.

All the other witnesses supported the idea of obtaining an area of 400 acres: and as matters are reported it appears as if the proposal will go through.

The evidence ends with a review of the Gardens of the world, showing Germany to possess 36, Italy 23, France 20, Russia 16, the United Kingdom 14, Austria-Hungary 13, the United States 12, and so on; but the whole British Empire contains 65. The size of the Gardens and some account of them follows. The new Botanic Garden at Kirstenbosch, Cape Town is credited with 400 acres, Kew with 288, Calcutta with 272, and several with 200. From that they descend until with the purely University Gardens we arrive at some of very small size.

A Botanic Reserve—Mount Maquiling.

The Government of the Philippine Islands has set aside Mount Maquiling, in the island of Luzon as a national reserve: it is to be kept for the students of animal and plant life, for those who wish to study the Fauna and Flora. The mountain is 1144 metres high (3753 feet); and is covered with virgin forest through which a few paths have been cut. At its foot are the laboratories of the College of Agriculture of Los Banos, and it is intended that one use of the reserve shall be for the training of foresters.

RAINFALL.

at the Director's house, Botanic Gardens, Singapore, during the first half of the year 1920.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin. Measurements in inches.

Date	January.	Feb.	March.	April.	May.	June.
1	3.65	0.43	...	...	0.10	Trace
2	1.65	...	...	Trace	...	...
3	3.82	...	0.61	...	0.14	...
4	0.18	...	0.16	...	0.21	...
5	0.08	...	0.14	..	0.20	...
6	0.02	0.03	2.02	Trace	0.01	...
7	Trace	0.02	0.05	...	...	...
8	0.40	0.15	...	0.72	...	0.96
9	Trace	0.01	...	Trace	...	0.07
10	...	...	...	...	1.03	0.02
11	0.60	...	...	Trace	0.72	1.27
12	0.65	...	Trace	Trace	...	...
13	...	...	..	...	0.72	...
14	Trace	Trace	...	0.34	0.86	...
15	...	...	8.85	0.15	0.02	0.40
16	...	1.65	Trace	...	Trace	0.02
17	...	...	Trace	Trace	...	0.03
18	...	...	1.12	0.34	...	0.05
19	2.34	...	Trace	0.35	...	0.03
20	Trace	0.15	0.84	0.07	...	0.03
21	0.17	0.50	0.05	...	...	...
22	Trace	0.03	0.23	Trace	0.11	...
23	...	1.59	0.35	0.05	0.41	...
24	...	Trace	...	Trace	1.31	0.46
25	...	1.02	0.23	0.09	...	0.28
26	0.10	Trace	0.63	...	Trace	...
27	...	1.26	0.05	0.09	...	...
28	0.40	0.42	0.08	Trace	...	...
29	...	0.02	...	...	Trace	...
30	...		...	1.48	0.20	...
31	0.39		...		0.07	
	14.36	7.23	7.42	0.68	5.48	3.62

RAINFALL.

at the Director's house, Botanic Gardens, Singapore, during the second half of the year 1920.

July.	August.	September.	October.	November.	December.
Trace	0.39	...	2.13	Trace	...
1.44	0.03	...	0.01	0.76	...
0.14	1.95	...	...	...	...
0.08	...	...	...	0.02	...
...	...	...	2.02	...	...
0.26	...	0.05	1.06	0.46	...
0.45	0.24	...	...	0.09	3.25
0.05	0.18	...	0.45	1.46	...
1.04	0.01	Trace	0.53	0.13	...
0.01	0.58	0.11	...	0.01	...
...	1.31	0.49	0.02	1.10	...
...	0.03	0.17	0.03	0.03	0.15
1.47	0.40	0.06	Trace	0.04	0,02
0.04	1.73	0.03	0 05	0 09	Trace
...	0.06	0.02	0.19	1.35	...
...	0.01	0.01	Trace	...	...
...	1.19	...	0.35	0.02	0.02
...	0.37	1.31	0.07	...	0.15
...	0.01	Trace	0.65	0.64	0.66
0.34	...	...	0.23	0.31	...
0.74	...	2.20	0.11	0.02	0.04
0.37	...	...	Trace	1.31	0.06
0.03	...	1.17	...	...	0.02
...	0.42	0.95	0.07	0.02	2.32
...	0.42	0.01	0.17	1.54	0.02
...	0.01	...	0.04	0.16	0.16
0.10	...	2.01	0.77	Trace	0.44
1.36	0.42	0.02	0.02	...	...
0.04	...	0.65	0.02	...	Trace
0.01	0.20	0.04	...	...	Trace
0.11	0.90		0.77		0.01
8.08	10.86	9.30	9.74	9.56	7.32

RAINFALL.

at the head of the Waterfall Gardens, Penang, during the first half of the year, 1914.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Measurements in inches.

Date.	January.	February	March.	April.	May.	June.
1	...	0.29	...	...	0.15	0.61
2	...	...	...	0.03	...	...
3	0.18	...	...	...	...	...
4	...	0.03	...	2.14	...	0.05
5	...	0.34	...	0.06	1.10	...
6	...	1.50	0.59	...	...	1.33
7	...	...	0.07	1.23	...	...
8	...	0.23	0.03	...	0.05	...
9	0.22	1.25	0.07	0.08	0.33	0.14
10	0.36	...	0.04	...	0.72	...
11	...	...	...	...	1.05	0.57
12	...	...	...	0.45	0.15	...
13	...	...	...	0.04	...	...
14	...	...	...	0.80	0.44	...
15	0.40	...	...	0.03	1.34	0.05
16	...	...	...	0.16	1.26	1.03
17	...	...	..	..	0.03	0.03
18	....	0.41	2.36	0.28	...	1.95
19	...	1.25	..	...	...	1.55
20	...	0.03	...	0.69	1.22	2.15
21	...	1.73	0.32	0.03	...	0.03
22	...	0.05	...	0.73	0.55	...
23	...	0.04	0.03	0.30	...	1.73
24	...	0.03	0.12	0.70	1.24	...
25	...	...	...	0.08	0.19	...
26	...	0.75	...	0.79	0.08	...
27	...	1.20	0.55	0.29	0.06	...
28	...	0.75	0.05	0.27	0.03	...
29	...	..	0.10	...	0.16	...
30	...		0.14	...	0.97	0.10
31	0.03		...	...	0.11	
	1.19	9.88	4.47	9.18	11 23	11.32

RAINFALL.

at the head of the Waterfall Gardens, Penang, during the second half of the year 1920

Date.	July.	August.	Sept.	October.	Nov.	Dec.
1	0.49	0.56	...	0.07	1.64	...
2	...	0.56	...	0.19	0.12	...
3	...	0.05	...	0.60	0.03	...
4	0.03	0.04	...	...	0.03	0.11
5	...	0.09	...	0.04	0.54	...
6	...	...	...	0.36	0.12	...
7	0.15	...	0.38	...	0.35	...
8	0 33	3.12	1.09	...	...	...
9	0.22	0.85	2.20	...	0.08	...
10	...	4.25	0.82	1.14	1.13	...
11	0.56	0.21	0.99	...	...	...
12	...	0.09	1.04	0.96	0.29	2.09
13	...	0 99	...	2.24	...	0.92
14	...	0.03	1.04	1.92	...	0.04
15	...	0.13	1.82	0.27	0.17	0.44
16	...	...	...	0.97	0.03	0.07
17	...	0.45	0.09	0.81	1 27	0.22
18	0.08	...	1.22	0.11	...	0.42
19	...	0.03	0.99	0.62	0.46	3.44
20	...	0.06	0.03	0.79	0.17	1.10
21	0 03	...	0.86	1.11	0.53	0.19
22	...	0.07	0 58	0.15	0.04	0.60
23	...	0.27	0.08	0.20	0 04	1.13
24	...	...	...	0.09	...	0.88
25	...	1.40	...	...	1 74	...
26	...	0.03	2.84	...	2 96	0.03
27	...	0.58	0.28	0.09	0.62	...
28	0.32	0.17	0.98	0.67	0.10	...
29	0.10	6.59	0.06	0.04	0 04	...
30	1.06	0.05	1.07	0.11	0.05	...
31	0.56	2.05		0.13		...
	3.93	22.72	18.46	13.68	12 55	11.68

SUMMARY OF RAINFALL, 1920.

	SINGAPORE.				PENANG.			
	No. of rainy days	Amount of rain in inches	in mm.	Longest Spell without rain	No. of rainy days	Amount of rain in inches	in mm.	Longest Spell without rain
January -	19	14.36	390	4 days.	5	1.19	30	15 days
February -	17	7.23	184	4	16	9.88	251	8
March -	19	7.42	188	4	13	4.47	114	7
April - -	19	3.68	93	3	20	9.18	233	2
May - -	18	5.46	139	5	21	11.23	285	3
June - -	13	3.62	92	6	14	11.32	288	6
July - -	20	8.08	205	5	12	3.93	100	6
August -	22	10.86	276	4	25	22.72	577	2
September	19	9.30	236	5	20	18.46	469	6
October -	25	9.74	247	2	24	13.88	353	3
November -	22	9.56	243	9	24	12.55	319	2
December -	17	7.32	186		15	11.68	297	7
Total ...	230	96.63	2454	...	209	130.31	3310	

	Singapore	Penang
Greatest amount in 24 hours	3.82 in. or 97 mm.	6.59 in. or 168 mm.
,, ,, 48 ,,	5.47 ,, 138 ,,	6.64 ,, 169 ,,
,, ,, 72 ,,	9.12 ,, 232 ,,	8.69 ,, 221 ,,

	Singapore		Penang
Excessively rainy periods, more than 5 00 having fallen in 72 hours (Jan.) -	1		3 June Aug. (2)
No. of days when condition persisted -	1		6
Periods of comparative drought, less than 0.02 having fallen in 120 hours Jan (2) Mch. April (2) June July (2) Sept. Dec. - - - - -	12		9 Jan. Feb. Mch. (2) June July (2) Sept. Dec.
No. of days when the condition occurred. - - - - - -	28		30